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14 March 2001
C6-BRC-T-01-009

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
Los Angeles Region
320 W. 4th Street, Suite 200
Los Angeles, CA 90013



Attention: John Geroch

Subject: **SAMPLING AND ANALYSIS PLAN SUPPLEMENTS NO. 4 AND 5
FOR BOEING REALTY CORPORATION, FORMER C-6 FACILITY,
19503 SOUTH NORMANDIE AVENUE, LOS ANGELES, CA**

Dear Mr. Geroch:

Please find enclosed for your review, copies of the subject documents prepared by Haley & Aldrich, Inc. for Boeing Realty Corporation.

If you have any questions concerning this document, please contact the undersigned at 562-593-8623.

Sincerely,

A handwritten signature in black ink, appearing to read "Stephanie Sibbett".

Stephanie Sibbett
Boeing Realty Corporation

Cc: Mario Stavale, Boeing Realty Corporation
Scott Lattimore, Long Beach Division

enclosure



**BOEING REALTY CORPORATION
FORMER C-6 FACILITY
LOS ANGELES, CALIFORNIA**

SAMPLING AND ANALYSIS PLAN SUPPLEMENT NO. 4

SOIL GAS SCREENING CONCENTRATIONS

To: Mr. Brian Mossman
Boeing Realty Corporation
3760 Kilroy Airport Way, Suite 500
Long Beach, CA 90806

From: Haley & Aldrich, Inc.

Date: March 2, 2001

Re: Soil Gas Screening Concentrations for the Boeing Realty Corporation, Former C-6 Facility, Los Angeles, California

Haley & Aldrich, Inc. is herein providing this technical memorandum as a supplement to the August 16, 2000 *Sampling and Analysis Plan* (SAP), prepared by Kennedy/Jenks Consultants (KJC) for Boeing Realty Corporation's (BRC's) Former C-6 Facility – Parcel C, Los Angeles, California (subject parcel). This SAP supplement presents a summary of the derivation of soil gas screening concentrations for use at the subject parcel.

OVERVIEW/PURPOSE

The subject soil gas screening concentrations will be used as a tool to assist with the assessment of soil gas impact delineation. The soil gas screening concentrations were derived for volatile organic compounds (VOCs) using conservative health-based assumptions for the vapor phase migration pathway.

The soil gas screening concentrations will be used to evaluate whether additional soil gas "step out" sampling is required for further delineation of soil gas concentrations. Should soil gas VOC concentrations be less than the soil gas screening values, it is likely that no further action would be required by the regulatory agencies for soil gas concentrations to be protective of human health from the potential vapor migration exposure pathway. If chemical concentrations at the limits of the soil gas plume are greater than the soil gas screening concentrations, it is recommended that additional "step-out" soil gas samples be obtained. Potential human health risk will be quantified later during the performance of the site-specific risk assessments in accordance with the November 29, 2000 document entitled *Risk Assessment Work Plan, Boeing Realty Corporation, Former C-6 Facility, Los Angeles, California* (Work Plan).

SUMMARY OF DERIVATION METHODOLOGY

Commercial/light industrial and residential soil gas screening concentrations were calculated for reasonable maximum exposure (RME) scenarios assuming upward VOC vapor migration and inhalation of indoor air. These soil gas screening concentrations were derived using the methodology described in the November 29, 2000 Work Plan, as detailed below.

The San Diego Department of Environmental Health (DEH) Site Assessment and Mitigation (SAM) vapor migration model was used to estimate indoor air concentrations. The Los Angeles Regional Water Quality Control Board (RWQCB) and the California Environmental Protection Agency (Cal-EPA) Office of Environmental Health Hazard Assessment (OEHHA) verbally approved the use of this model for the subject property. Chemical parameters were obtained from online information sources including:

- the U.S. Environmental Protection Agency Region 9 preliminary remediation goal data sheets,
- the U.S. National Library of Medicine Hazardous Substance Data Bank (HSDB), and
- Risk Assessment Information System (RAIS) Toxicity & Chemical-Specific Factors Data Base.

Geotechnical input parameters including dry bulk density, total and air-filled porosity, and total organic carbon (TOC) were obtained from analysis of representative soil samples obtained on the subject property.

Exposure parameters for the RME scenarios were obtained from Section 7 of the November 29, 2000 Work Plan. Residential exposure parameters were weighted for a child (6 years, ages 1 through 6) and an adult (24 years) over a 30-year exposure period. It was assumed that impacts are present at a depth of 10 feet below ground surface (the depth that the soil gas samples are being collected), and extend beneath the entire footprint of a single-story structure. Model default parameters were used for concrete foundation attenuation factor (0.01), and the building air exchange rate (0.5 exchanges per hour for a residence, and 0.83 exchanges per hour for a commercial or industrial building).

Toxicity values were updated from the following online sources in order of priority:

1. Cal-EPA OEHHA, Toxicity Criteria Database and December 2000 California Cancer Potency Values, <http://www.oehha.ca.gov/risk/chemicalDB/index.asp>
2. Cal-EPA, Air Resources Board (ARB), Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values, October 10, 2000, <http://www.arb.ca.gov/ab2588/riskassess.htm>
3. EPA Region 9, Preliminary Remediation Goals (PRGs), 2000.

The various input parameters and model results are presented in Appendix A for the residential scenario and in Appendix B for the commercial/light industrial scenario.

SOIL GAS SCREENING CONCENTRATIONS

The soil gas screening concentrations are presented in Table 1. These values are based on the lowest estimated soil gas concentration associated with either an excess lifetime cancer risk of one in a million (1×10^{-6}) or a hazard index of 0.33 for potential noncancer adverse health effects. Since the acceptable risk thresholds identified in the November 29, 2000 Work Plan are an excess lifetime cancer risk of 1×10^{-5} and a hazard index of 1.0, the soil gas screening concentrations have been developed to address possible compound additivity of adverse health effects when conducting the risk assessments.

Should you have any questions concerning the contents of this technical memorandum, please contact the undersigned at (619) 405-5436.

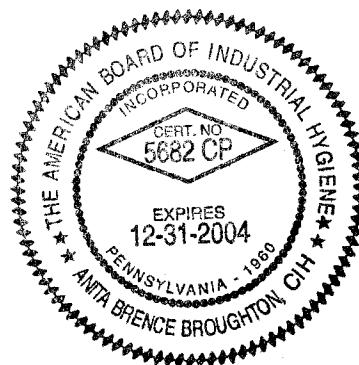
Sincerely yours,
HALEY & ALDRICH, INC.



Anita Broughton, REA, CIH
Risk Assessment Task Manager



Scott Zachary
Project Manager



Attachments:

Table 1 Soil Gas Screening Concentrations

Appendix A Input Parameters and Model Results for Derivation of Soil Gas Screening Concentrations – Residential Scenario

Appendix B Input Parameters and Model Results for Derivation of Soil Gas Screening Concentrations – Commercial/Light Industrial Scenario

TABLE 1. Soil Gas Screening Concentrations
BRC Former C-6 Facility, Los Angeles, California

CAS No.	Chemical	Residential (mg/m ³)	Commercial/ Light Industrial (mg/m ³)
79-01-6	Trichloroethylene (TCE)	1170	2970
127-18-4	Tetrachloroethylene (PCE)	612	1550
75-09-2	Methylene Chloride	2640	6690
71-55-6	1,1,1-Trichloroethane (1,1,1-TCA)	454000	958000
75-35-4	1,1-Dichloroethylene (1,1-DCE)	57.1	145
156-59-2	cis-1,2-Dichloroethylene (cis 1,2-DCE)	16500	34800
156-60-5	trans-1,2-Dichloroethylene (trans-1,2-DCE)	34400	72600
75-01-4	Vinyl Chloride	31.2	78.9
75-34-3	1,1 - Dichloroethane (1,1-DCA)	2190	5550
79-00-5	1,1,2 - TCA	208	527
71-43-2	Benzene	105	266
67-66-3	Chloroform	487	1230
100-41-4	Ethylbenzene	928000	1960000
78-93-3	Methyl Ethyl Ketone	190000	401000
1634-04-4	MTBE	3510000	7410000
91-20-3	Naphthalene	5380	11400
108-88-3	Toluene	121000	255000
75-69-4	Trichlorofluoromethane (Freon 11)	281000	592000
1330-20-7	Xylenes	349000	736000
107-06-2	1,2-Dichloroethane (EDC)	132	335
75-71-8	Dichlorodifluoromethane	87000	184000
56-23-5	Carbon tetrachloride	79	200

Units of milligrams per cubic meter (mg/m³) are equal to units of micrograms per Liter (ug/L)

CAS = Chemical Abstract Service

Appendix A

Appendix A

Input Parameters and Model Results for Derivation of Soil Gas Screening Concentrations – Residential Scenario

SUMMARY OF SOIL GAS SCREENING CONCENTRATIONS - RESIDENTIAL SCENARIO
BRCA Former C-6 Facility, Los Angeles, California

CAS No.	Chemical	Cancer Risk (=1.0E-06)	Hazard Index or (=3.3E-01)	Soil Gas Screening Concentration (mg/m ³)
79-01-6	Trichloroethylene (TCE)	1.0E-06	1.5E-03	1.17E+03
127-18-4	Tetrachloroethylene (PCE)	1.0E-06	1.2E-02	6.12E+02
75-09-2	Methylene Chloride	1.0E-06	6.5E-03	2.64E+03
71-55-6	1,1,1-Trichloroethane (1,1,1-TCA)	No Slope Factor	3.3E-01	4.54E+05
75-35-4	1,1-Dichloroethylene (1,1-DCE)	1.0E-06	1.5E-03	5.71E+01
156-59-2	cis-1,2-Dichloroethylene (cis-1,2-DCE)	No Slope Factor	3.3E-01	1.65E+04
156-60-5	trans-1,2-Dichloroethylene (trans-1,2-DCE)	No Slope Factor	3.3E-01	3.44E+04
75-01-4	Vinyl Chloride	1.0E-06	1.2E-03	3.12E+01
75-34-3	1,1 - Dichloroethane (1,1-DCA)	1.0E-06	3.1E-03	2.19E+03
79-00-5	1,1,2 - TCA	1.0E-06	1.1E-02	2.08E+02
71-43-2	Benzene	1.0E-06	1.5E-03	1.05E+02

Notes:

The indicated soil gas screening concentration for each chemical represents the lower of the chemical concentrations that represents a cancer risk of 1×10^{-6} or a hazard index of 0.33. For instance, the concentration associated with a cancer risk of 1×10^{-6} was chosen as the soil gas screening concentration if the hazard index associated with that concentration is less than 0.33. Alternatively, the concentration associated with an hazard index of 0.33 was chosen if that chemical does not have a cancer slope factor or if the estimated cancer risk associated with that concentration is less than 1×10^{-6} .

In some cases, calculated soil gas screening concentrations may be greater than the soil pore gas saturation concentration.

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL**Risk Calculations**

Page 1-2

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California**Chemical:** Trichloroethylene (TCE)

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION**A. SOURCE - Free Product/Soil>100mg/kg.**

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.30E+05	mg/mole
Vapor pressure	VP	=	7.61E-02	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg(fp)}	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	ug/l	
Henry's Law Constant	H	=	4.20E-01	dimensionless
Calculated soil gas concentration	C_{sg(gw)}	=	0.00E+00	mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg	
Henry's Law Constant	H	=	4.20E-01	dimensionless
Bulk density (dry)	P _b	=	1.54E+00	gm/cc
Air-filled porosity	θ _a	=	1.66E-01	dimensionless
Water-filled porosity	θ _w	=	2.57E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	1.04E-01	dimensionless
Organic carbon partition coefficient	K _{oc}	=	9.40E+01	cm ³ /gm
Soil/water distribution coef.	K _d	=	9.80E+00	cm ³ /gm
Calculated soil gas concentration	C_{sg(s)}	=	0.00E+00	mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg(m)}	=	1.17E+03	mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 1.17E+03 mg/m3**DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE**

Total porosity	θ	=	4.23E-01	dimensionless
Air-filled porosity	θ _a	=	1.66E-01	dimensionless
Diffusion coefficient in air	D _a	=	7.90E-02	cm ² /sec
Effective diffusion coefficient	D_e	=	1.11E-03	cm²/sec
Depth of contamination or C _{sg}	X	=	3.05E+00	m
Calculated Flux	F_x	=	1.53E-01	mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Risk Calculations

Page 2-2

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m ³ /hr
Indoor air component	C_i	=	1.26E-03 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

	C _t	=	1.26E-03 mg/m ³
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EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m ³ /hr
Inhalation rate	IR	=	1.22E+01 m ³ /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
Chemical Intake (carc. risk)	IT_c	=	9.99E-05 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	2.50E-04 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	2.50E-04 mg/kg-day
Reference dose	RfD	=	1.70E-01 mg/kg-day
Hazard Index	HI	=	1.47E-03

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	9.99E-05 mg/kg-day
Slope factor (potency)	SF	=	1.00E-02 1/(mg/kg-day)
Cancer Risk	Risk	=	9.99E-07

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Risk Calculations

Page 1-2

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Tetrachloroethylene (PCE)

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.70E+05	mg/mole
Vapor pressure	VP	=	2.43E-02	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	ug/l	
Henry's Law Constant	H	=	7.50E-01	dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	0.00E+00	mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg	
Henry's Law Constant	H	=	7.50E-01	dimensionless
Bulk density (dry)	P _b	=	1.54E+00	gm/cc
Air-filled porosity	θ _a	=	1.66E-01	dimensionless
Water-filled porosity	θ _w	=	2.57E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	1.04E-01	dimensionless
Organic carbon partition coefficient	K _{oc}	=	2.70E+02	cm ³ /gm
Soil/water distribution coef.	K _d	=	2.81E+01	cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00	mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg} (m)	=	6.12E+02	mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 6.12E+02 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.23E-01	dimensionless
Air-filled porosity	θ _a	=	1.66E-01	dimensionless
Diffusion coefficient in air	D _a	=	7.20E-02	cm ² /sec
Effective diffusion coefficient	D_e	=	1.01E-03	cm²/sec
Depth of contamination or C _{sg}	X	=	3.05E+00	m
Calculated Flux	F_x	=	7.30E-02	mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m ³ /hr
Indoor air component	C_i	=	5.98E-04 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

	C _t	=	5.98E-04 mg/m ³
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EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m ³ /hr
Inhalation rate	IR	=	1.22E+01 m ³ /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
Chemical Intake (carc. risk)	IT_c	=	4.76E-05 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	1.19E-04 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	1.19E-04 mg/kg-day
Reference dose	RfD	=	1.00E-02 mg/kg-day
Hazard Index	HI	=	1.19E-02

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	4.76E-05 mg/kg-day
Slope factor (potency)	SF	=	2.10E-02 1/(mg/kg-day)
Cancer Risk	Risk	=	1.00E-06

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Methylene Chloride

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	8.50E+04	mg/mole
Vapor pressure	VP	=	5.72E-01	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	ug/l	
Henry's Law Constant	H	=	9.00E-02	dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	0.00E+00	mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg	
Henry's Law Constant	H	=	9.00E-02	dimensionless
Bulk density (dry)	ρ _b	=	1.54E+00	gm/cc
Air-filled porosity	θ _a	=	1.66E-01	dimensionless
Water-filled porosity	θ _w	=	2.57E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	1.04E-01	dimensionless
Organic carbon partition coefficient	K _{oc}	=	1.00E+01	cm ³ /gm
Soil/water distribution coef.	K _d	=	1.04E+00	cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00	mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg}(m)	=	2.64E+03	mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 2.64E+03 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.23E-01	dimensionless
Air-filled porosity	θ _a	=	1.66E-01	dimensionless
Diffusion coefficient in air	D _a	=	1.00E-01	cm ² /sec
Effective diffusion coefficient	D_e	=	1.40E-03	cm²/sec
Depth of contamination or C _{sg}	X	=	3.05E+00	m
Calculated Flux	F_x	=	4.37E-01	mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Risk Calculations

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Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m ³ /hr
Indoor air component	C_i	=	3.58E-03 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m

Outdoor air component

$$C_o = 0.00E+00 \text{ mg/m}^3$$

C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 3.58E-03 \text{ mg/m}^3$$

EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m ³ /hr
Inhalation rate	IR	=	1.22E+01 m ³ /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
Chemical Intake (carc. risk)	IT_c	=	2.85E-04 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	7.13E-04 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	7.13E-04 mg/kg-day
Reference dose	RfD	=	1.10E-01 mg/kg-day
Hazard Index	HI	=	6.48E-03

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	2.85E-04 mg/kg-day
Slope factor (potency)	SF	=	3.50E-03 1/(mg/kg-day)
Cancer Risk	Risk	=	9.98E-07

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL
Risk Calculations

Page 1-2

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: 1,1,1-Trichloroethane (1,1,1-TCA)

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.30E+05	mg/mole
Vapor pressure	VP	=	1.63E-01	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	ug/l	
Henry's Law Constant	H	=	7.10E-01	dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	0.00E+00	mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg	
Henry's Law Constant	H	=	7.10E-01	dimensionless
Bulk density (dry)	ρ _b	=	1.54E+00	gm/cc
Air-filled porosity	θ _a	=	1.66E-01	dimensionless
Water-filled porosity	θ _w	=	2.57E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	1.04E-01	dimensionless
Organic carbon partition coefficient	K _{oc}	=	1.40E+02	cm ³ /gm
Soil/water distribution coef.	K _d	=	1.46E+01	cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00	mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg}(m)	=	4.54E+05	mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 4.54E+05 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.23E-01	dimensionless
Air-filled porosity	θ _a	=	1.66E-01	dimensionless
Diffusion coefficient in air	D _a	=	7.80E-02	cm ² /sec
Effective diffusion coefficient	D_e	=	1.09E-03	cm²/sec
Depth of contamination or C _{sg}	X	=	3.05E+00	m
Calculated Flux	F_x	=	5.87E+01	mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m ³ /hr
Indoor air component	C_i	=	4.81E-01 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³
C. TOTAL INDOOR AIR CONCENTRATION	C_t	=	4.81E-01 mg/m³

EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m ³ /hr
Inhalation rate	IR	=	1.22E+01 m ³ /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
Chemical Intake (carc. risk)	IT_c	=	3.83E-02 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	9.57E-02 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	9.57E-02 mg/kg-day
Reference dose	RfD	=	2.90E-01 mg/kg-day
Hazard Index	HI	=	3.30E-01

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	3.83E-02 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
Cancer Risk	Risk	=	No Slope Factor

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Risk Calculations

Page 1-2

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: 1,1-Dichloroethylene (1,1-DCE)

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	9.70E+04	mg/mole
Vapor pressure	VP	=	7.78E-01	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	ug/l	
Henry's Law Constant	H	=	1.10E+00	dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	0.00E+00	mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg	
Henry's Law Constant	H	=	1.10E+00	dimensionless
Bulk density (dry)	P _b	=	1.54E+00	gm/cc
Air-filled porosity	θ _a	=	1.66E-01	dimensionless
Water-filled porosity	θ _w	=	2.57E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	1.04E-01	dimensionless
Organic carbon partition coefficient	K _{oc}	=	6.50E+01	cm ³ /gm
Soil/water distribution coef.	K _d	=	6.78E+00	cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00	mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg} (m)	=	5.71E+01	mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 5.71E+01 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.23E-01	dimensionless
Air-filled porosity	θ _a	=	1.66E-01	dimensionless
Diffusion coefficient in air	D _a	=	9.00E-02	cm ² /sec
Effective diffusion coefficient	D_e	=	1.26E-03	cm²/sec
Depth of contamination or C _{sg}	X	=	3.05E+00	m
Calculated Flux	F_x	=	8.51E-03	mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING**A. INDOOR AIR COMPONENT**

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m ³ /hr
Indoor air component	C_i	=	6.98E-05 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³
C. TOTAL INDOOR AIR CONCENTRATION	C_t	=	6.98E-05 mg/m³

EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m ³ /hr
Inhalation rate	IR	=	1.22E+01 m ³ /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
Chemical Intake (carc. risk)	IT_c	=	5.55E-06 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	1.39E-05 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	1.39E-05 mg/kg-day
Reference dose	RfD	=	9.10E-03 mg/kg-day
Hazard Index	HI	=	1.53E-03

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	5.55E-06 mg/kg-day
Slope factor (potency)	SF	=	1.80E-01 1/(mg/kg-day)
Cancer Risk	Risk	=	1.00E-06

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Risk Calculations

Page 1-2

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: cis-1,2-Dichloroethylene (cis 1,2-DCE)

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	9.70E+04	mg/mole
Vapor pressure	VP	=	2.40E-04	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	ug/l	
Henry's Law Constant	H	=	1.70E-01	dimensionless
Calculated soil gas concentration	C_{sg(gw)}	=	0.00E+00	mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg	
Henry's Law Constant	H	=	1.70E-01	dimensionless
Bulk density (dry)	ρ _b	=	1.54E+00	gm/cc
Air-filled porosity	θ _a	=	1.66E-01	dimensionless
Water-filled porosity	θ _w	=	2.57E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	1.04E-01	dimensionless
Organic carbon partition coefficient	K _{oc}	=	3.60E+01	cm ³ /gm
Soil/water distribution coef.	K _d	=	3.75E+00	cm ³ /gm
Calculated soil gas concentration	C_{sg(s)}	=	0.00E+00	mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg(m)}	=	1.65E+04	mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 1.65E+04 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.23E-01	dimensionless
Air-filled porosity	θ _a	=	1.66E-01	dimensionless
Diffusion coefficient in air	D _a	=	7.40E-02	cm ² /sec
Effective diffusion coefficient	D_e	=	1.04E-03	cm²/sec
Depth of contamination or C _{sg}	X	=	3.05E+00	m
Calculated Flux	F_x	=	2.02E+00	mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m ³ /hr
Indoor air component	C_i	=	1.66E-02 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 1.66E-02 \text{ mg/m}^3$$

EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m ³ /hr
Inhalation rate	IR	=	1.22E+01 m ³ /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
 Chemical Intake (carc. risk)	IT_c	=	1.32E-03 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	3.30E-03 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	3.30E-03 mg/kg-day
Reference dose	RfD	=	1.00E-02 mg/kg-day
Hazard Index	HI	=	3.30E-01

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	1.32E-03 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
Cancer Risk	Risk	=	No Slope Factor

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California**Chemical:** trans-1,2-Dichloroethylene (trans-1,2-DCE)**Variable Descriptions** **Units****CALCULATION OF SOIL GAS CONCENTRATION****A. SOURCE - Free Product/Soil>100mg/kg.**

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	9.70E+04	mg/mole
Vapor pressure	VP	=	5.20E-01	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	1.70E+07	ug/l
Henry's Law Constant	H	=	3.80E-01	dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	6.46E+06	mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=		mg/kg
Henry's Law Constant	H	=	3.80E-01	dimensionless
Bulk density (dry)	ρ _b	=	1.54E+00	gm/cc
Air-filled porosity	θ _a	=	1.66E-01	dimensionless
Water-filled porosity	θ _w	=	2.57E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	1.04E-01	dimensionless
Organic carbon partition coefficient	K _{oc}	=	3.80E+01	cm ³ /gm
Soil/water distribution coef.	K _d	=	3.96E+00	cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00	mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg}(m)	=	3.44E+04	mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 3.44E+04 mg/m3**DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE**

Total porosity	θ	=	4.23E-01	dimensionless
Air-filled porosity	θ _a	=	1.66E-01	dimensionless
Diffusion coefficient in air	D _a	=	7.10E-02	cm ² /sec
Effective diffusion coefficient	D_e	=	9.96E-04	cm²/sec
Depth of contamination or C _{sg}	X	=	3.05E+00	m
Calculated Flux	F_x	=	4.05E+00	mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m ³ /hr
Indoor air component	C_i	=	3.32E-02 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

	C _t	=	3.32E-02 mg/m ³
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EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m ³ /hr
Inhalation rate	IR	=	1.22E+01 m ³ /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
Chemical Intake (carc. risk)	IT_c	=	2.64E-03 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	6.60E-03 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	6.60E-03 mg/kg-day
Reference dose	RfD	=	2.00E-02 mg/kg-day
Hazard Index	HI	=	3.30E-01

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	2.64E-03 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
Cancer Risk	Risk	=	No Slope Factor

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Risk Calculations

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Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Vinyl Chloride

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	6.30E+04	mg/mole
Vapor pressure	VP	=	3.50E+00	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	ug/l	
Henry's Law Constant	H	=	1.10E+00	dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	0.00E+00	mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg	
Henry's Law Constant	H	=	1.10E+00	dimensionless
Bulk density (dry)	P _b	=	1.54E+00	gm/cc
Air-filled porosity	θ _a	=	1.66E-01	dimensionless
Water-filled porosity	θ _w	=	2.57E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	1.04E-01	dimensionless
Organic carbon partition coefficient	K _{oc}	=	1.90E+01	cm ³ /gm
Soil/water distribution coef.	K _d	=	1.98E+00	cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00	mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg}(m)	=	3.12E+01	mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 3.12E+01 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.23E-01	dimensionless
Air-filled porosity	θ _a	=	1.66E-01	dimensionless
Diffusion coefficient in air	D _a	=	1.10E-01	cm ² /sec
Effective diffusion coefficient	D_e	=	1.54E-03	cm²/sec
Depth of contamination or C _{sg}	X	=	3.05E+00	m
Calculated Flux	F_x	=	5.69E-03	mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m ³ /hr
Indoor air component	C_i	=	4.66E-05 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

	C _t	=	4.66E-05 mg/m ³
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EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m ³ /hr
Inhalation rate	IR	=	1.22E+01 m ³ /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
Chemical Intake (carc. risk)	IT_c	=	3.71E-06 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	9.27E-06 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	9.27E-06 mg/kg-day
Reference dose	RfD	=	7.43E-03 mg/kg-day
Hazard Index	HI	=	1.25E-03

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	3.71E-06 mg/kg-day
Slope factor (potency)	SF	=	2.70E-01 1/(mg/kg-day)
Cancer Risk	Risk	=	1.00E-06

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL
Risk Calculations

Page 1-2

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: 1,1 - Dichloroethane (1,1-DCA)

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	9.90E+04	mg/mole
Vapor pressure	VP	=	3.08E-01	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	ug/l	
Henry's Law Constant	H	=	2.30E-01	dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	0.00E+00	mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg	
Henry's Law Constant	H	=	2.30E-01	dimensionless
Bulk density (dry)	ρ _b	=	1.54E+00	gm/cc
Air-filled porosity	θ _a	=	1.66E-01	dimensionless
Water-filled porosity	θ _w	=	2.57E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	1.04E-01	dimensionless
Organic carbon partition coefficient	K _{oc}	=	5.30E+01	cm ³ /gm
Soil/water distribution coef.	K _d	=	5.53E+00	cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00	mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg}(m)	=	2.19E+03	mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 2.19E+03 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.23E-01	dimensionless
Air-filled porosity	θ _a	=	1.66E-01	dimensionless
Diffusion coefficient in air	D _a	=	7.40E-02	cm ² /sec
Effective diffusion coefficient	D_e	=	1.04E-03	cm²/sec
Depth of contamination or C _{sg}	X	=	3.05E+00	m
Calculated Flux	F_x	=	2.68E-01	mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Risk Calculations

Page 2-2

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m ³ /hr
Indoor air component	C_i	=	2.20E-03 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³
C. TOTAL INDOOR AIR CONCENTRATION	C_t	=	2.20E-03 mg/m³

EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m ³ /hr
Inhalation rate	IR	=	1.22E+01 m ³ /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
Chemical Intake (carc. risk)	IT_c	=	1.75E-04 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	4.38E-04 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	4.38E-04 mg/kg-day
Reference dose	RfD	=	1.40E-01 mg/kg-day
Hazard Index	HI	=	3.13E-03

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	1.75E-04 mg/kg-day
Slope factor (potency)	SF	=	5.70E-03 1/(mg/kg-day)
Cancer Risk	Risk	=	9.98E-07

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: 1,1,2 - TCA

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.30E+05	mg/mole
Vapor pressure	VP	=	3.10E-02	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	ug/l	
Henry's Law Constant	H	=	3.70E-02	dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	0.00E+00	mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg	
Henry's Law Constant	H	=	3.70E-02	dimensionless
Bulk density (dry)	ρ _b	=	1.54E+00	gm/cc
Air-filled porosity	θ _a	=	1.66E-01	dimensionless
Water-filled porosity	θ _w	=	2.57E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	1.04E-01	dimensionless
Organic carbon partition coefficient	K _{oc}	=	7.50E+01	cm ³ /gm
Soil/water distribution coef.	K _d	=	7.82E+00	cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00	mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg}(m)	=	2.08E+02	mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 2.08E+02 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.23E-01	dimensionless
Air-filled porosity	θ _a	=	1.66E-01	dimensionless
Diffusion coefficient in air	D _a	=	7.80E-02	cm ² /sec
Effective diffusion coefficient	D_e	=	1.09E-03	cm²/sec
Depth of contamination or C _{sg}	X	=	3.05E+00	m
Calculated Flux	F_x	=	2.69E-02	mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m ³ /hr
Indoor air component	C_i	=	2.20E-04 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 2.20E-04 \text{ mg/m}^3$$

EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m ³ /hr
Inhalation rate	IR	=	1.22E+01 m ³ /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
Chemical Intake (carc. risk)	IT_c	=	1.75E-05 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	4.38E-05 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	4.38E-05 mg/kg-day
Reference dose	RfD	=	4.00E-03 mg/kg-day
Hazard Index	HI	=	1.10E-02

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	1.75E-05 mg/kg-day
Slope factor (potency)	SF	=	5.70E-02 1/(mg/kg-day)
Cancer Risk	Risk	=	9.99E-07

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Benzene

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	7.80E+04	mg/mole
Vapor pressure	VP	=	1.25E-01	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=		ug/l
Henry's Law Constant	H	=	2.30E-01	dimensionless
Calculated soil gas concentration	C_{sg(gw)}	=	0.00E+00	mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=		mg/kg
Henry's Law Constant	H	=	2.30E-01	dimensionless
Bulk density (dry)	ρ _b	=	1.54E+00	gm/cc
Air-filled porosity	θ _a	=	1.66E-01	dimensionless
Water-filled porosity	θ _w	=	2.57E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	1.04E-01	dimensionless
Organic carbon partition coefficient	K _{oc}	=	6.20E+01	cm ³ /gm
Soil/water distribution coef.	K _d	=	6.46E+00	cm ³ /gm
Calculated soil gas concentration	C_{sg(s)}	=	0.00E+00	mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg(m)}	=	1.05E+02	mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 1.05E+02 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.23E-01	dimensionless
Air-filled porosity	θ _a	=	1.66E-01	dimensionless
Diffusion coefficient in air	D _a	=	8.80E-02	cm ² /sec
Effective diffusion coefficient	D_e	=	1.23E-03	cm²/sec
Depth of contamination or C _{sg}	X	=	3.05E+00	m
Calculated Flux	F_x	=	1.53E-02	mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m ³ /hr
Indoor air component	C_i	=	1.25E-04 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

	C _t	=	1.25E-04 mg/m ³
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EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m ³ /hr
Inhalation rate	IR	=	1.22E+01 m ³ /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
Chemical Intake (carc. risk)	IT_c	=	9.98E-06 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	2.50E-05 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	2.50E-05 mg/kg-day
Reference dose	RfD	=	1.70E-02 mg/kg-day
Hazard Index	HI	=	1.47E-03

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	9.98E-06 mg/kg-day
Slope factor (potency)	SF	=	1.00E-01 1/(mg/kg-day)
Cancer Risk	Risk	=	9.98E-07

GEOTECHNICAL PARAMETERS

Sample ID	Date Sampled	Depth (feet bgs)	Sieve Analysis (Soil Type)	Dry Bulk Density (g/cm ³)	Moisture Content (percent by weight)	Total Porosity (fraction by volume)	Air-filled Porosity (fraction by volume)	Water-filled Porosity (fraction by volume)	TOC* (mg/kg)	f_{oc} (fraction by weight)	
I-34-4.5	1/22/2001	4.5	Silt	1.87	18.9	0.31	0.05	0.26	610	0.06	
EIA290176-001 (I-34-5)	1/29/2001	5	Silt	1.51	15.9	0.43	0.19	0.24	520	0.05	
EIA290176-010 (D-29-5)	1/29/2001	5	Silt	1.44	20.3	0.46	0.16	0.29	2350	0.24	
EIA29176-018 (I-25-5)	1/29/2001	5	Silt	1.34	17.8	0.49	0.26	0.24	690	0.07	
Average				1.54			0.42	0.17	0.26	1043	0.10

Notes:

The air-filled porosity values were calculated from gravimetric data, not volumetric data.

* f_{oc} = the weight fraction of organic carbon in soil = TOC/10,000

CHEMICAL PARAMETERS

CAS No.	MW (mg/mole)	H ⁺ (dimension-less)	Da (cm ² /sec)	VP (atm)	Temp. (°C)	K _{ac} (cm ³ /g)	Water Solubility (mg/L-water)	CSF (inh) (mg/kg-day) ⁻¹	Chronic RfD (inh) (mg/kg-day)	
									Water Solubility (mg/L-water)	CSF (inh) (mg/kg-day) ⁻¹
79-01-6 Trichloroethylene (TCE)	1.3E+05	a	4.2E-01	a	7.9E-02	b	9.4E+01	a	1.1E+03	1.0E-02
127-18-4 Tetrachloroethylene (PCE)	1.7E+05	a	7.5E-01	a	7.2E-02	a	2.4E-02	25	2.7E+02	2.1E-02
75-09-2 Methylene Chloride	8.5E+04	a	9.0E-02	a	1.0E-01	a	5.7E-01	25	1.0E+04	3.5E-03
71-55-6 1,1,1-Trichloroethane (1,1,1-TCA)	1.3E+05	a	7.1E-01	a	7.8E-02	a	1.6E-01	25	1.4E+02	1.1E-01
75-35-4 1,1-Dichloroethylene (1,1-DCE)	9.7E+04	a	1.1E+00	a	9.0E-02	a	7.8E-01	25	6.5E+01	2.9E-01
156-59-2 cis-1,2-Dichloroethylene (cis 1,2-DCE)	9.7E+04	a	1.7E-01	a	7.4E-02	a	2.4E-04	20	3.6E+01	1.8E-01
156-50-6 trans-1,2-Dichloroethylene (trans 1,2-DCE)	9.7E+04	a	3.8E-01	a	7.1E-02	a	5.2E-01	30	3.8E+01	3.5E+03
75-01-4 Vinyl Chloride	6.3E+04	a	1.1E+00	a	1.1E-01	a	3.5E+00	25	1.9E+01	2.80E+03
75-34-3 1,1 - Dichloroethane (1,1-DCA)	9.9E+04	a	2.3E-01	a	7.4E-02	a	3.1E-01	25	5.3E+01	5.1E+03
79-00-5 1,1,2 - TCA	1.3E+05	a	3.7E-02	a	7.8E-02	a	3.1E-02	25	7.5E+01	4.4E+03
71-43-2 Benzene	7.8E+04	a	2.3E-01	a	8.8E-02	a	1.2E-01	25	6.2E+01	4.0E-03
67-66-3 Chloroform	1.2E+05	a	1.5E-01	a	1.0E-01	a	2.6E-01	25	5.3E+01	1.0E-01
100-41-4 Ethylbenzene	1.1E+05	a	3.2E-01	a	7.5E-02	a	1.3E-02	25	2.0E+02	5.7E-01
78-93-3 Methyl Ethyl Ketone	7.2E+04	a	1.1E-03	a	9.0E-02	a	1.2E-01	25	4.5E+00	1.4E-01
1634-04-4 MTBE	8.5E+04	a	2.4E-02	a	8.0E-02	a	3.3E-01	25	6.0E+00	2.3E+00
91-20-3 Naphthalene	1.3E+05	a	2.0E-02	a	5.9E-02	a	1.0E-04	b	1.2E+03	1.7E-02
108-88-3 Toluene	9.2E+04	a	2.7E-01	a	8.7E-02	a	3.7E-02	25	1.4E+02	8.6E-02
75-69-4 Trichlorofluoromethane (Freon 11)	1.4E+05	a	4.0E+00	a	8.7E-02	a	1.0E+00	25	1.6E+02	1.0E+03
1330-20-7 Xylenes	1.1E+05	a	3.0E-01	a	7.0E-02	a	1.1E-02	25	2.0E+02	1.6E+02
107-06-2 1,2-Dichloroethane (EDC)	9.9E+04	a	4.0E-02	a	1.0E-01	a	1.1E-01	25	3.8E+01	8.5E+03
75-71-8 Dichlorodifluoromethane	1.2E+05	a	4.1E-00	a	8.0E-02	a	5.8E-00	21	5.8E+01	7.0E-02
55-23-5 Carbon tetrachloride	1.5E+05	a	1.2E+00	a	7.8E-02	a	1.5E-01	25	6.9E+02	5.7E-02

References:

a EPA Region 9, Preliminary Remediation Goals (PRGs), 2000.

b U.S. National Library of Medicine Hazardous Substance Data Bank (HSDB), <http://www.nlm.nih.gov/pubs/factsheets/hsdbfs.html>

c Cal-EPA Office of Environmental Health Hazard Assessment (OEHHA), Toxicity Criteria Database and December 2000 California Cancer Potency Values, <http://www.oehha.ca.gov/risk/chemicalDB/index.asp>

d Risk Assessment Information System (RAIS) Toxicity & Chemical-Specific Factors Data Base, January 2001, http://risk.lsds.orri.gov/cgi-bin/tox/TOX_select?select=csf

e Cal-EPA, Air Resources Board (ARB), Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values, October 10, 2000, <http://www.arb.ca.gov/ab2588/riskassess.htm>

Toxicity Value reference priority:

1. Cal-EPA Office of Environmental Health Hazard Assessment (OEHHA), Toxicity Criteria Database and December 2000 California Cancer Potency Values, <http://www.oehha.ca.gov/risk/chemicalDB/index.asp>

2. Cal-EPA, Air Resources Board (ARB), Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values, October 10, 2000, <http://www.arb.ca.gov/ab2588/riskassess.htm>

3. EPA Region 9, Preliminary Remediation Goals (PRGs), 2000.

SUMMARY OF SOIL GAS SCREENING CONCENTRATIONS - RESIDENTIAL SCENARIO
BRC Former C-6 Facility, Los Angeles, California

CAS No.	Chemical	Cancer Risk (=1.0E-06)	Hazard Index or (=3.3E-01)	Soil Gas Screening Concentration (mg/m ³)
79-01-6	Trichloroethylene (TCE)	1.0E-06	1.5E-03	1.17E+03
67-66-3	Chloroform	1.0E-06	1.5E-03	4.87E+02
100-41-4	Ethylbenzene	No Slope Factor	3.3E-01	9.28E+05
78-93-3	Methyl Ethyl Ketone	No Slope Factor	3.3E-01	1.90E+05
1634-04-4	MTBE	No Slope Factor	3.3E-01	3.51E+06
91-20-3	Naphthalene	No Slope Factor	3.3E-01	5.38E+03
108-88-3	Toluene	No Slope Factor	3.3E-01	1.21E+05
75-69-4	Trichlorofluoromethane (Freon 11)	No Slope Factor	3.3E-01	2.81E+05
1330-20-7	Xylenes	No Slope Factor	3.3E-01	3.49E+05
107-06-2	1,2-Dichloroethane (EDC)	1.0E-06	1.3E-03	1.32E+02
75-71-8	Dichlorodifluoromethane	No Slope Factor	3.3E-01	8.70E+04
56-23-5	Carbon tetrachloride	1.0E-06	2.4E-02	7.91E+01

Notes:

The indicated soil gas screening concentration for each chemical represents the lower of the chemical concentrations that represents a cancer risk of 1×10^{-6} or a hazard index of 0.33. For instance, the concentration associated with a cancer risk of 1×10^{-6} was chosen as the soil gas screening concentration if the hazard index associated with that concentration is less than 0.33. Alternatively, the concentration associated with an hazard index of 0.33 was chosen if that chemical does not have a cancer slope factor or if the estimated cancer risk associated with that concentration is less than 1×10^{-6} .

In some cases, calculated soil gas screening concentrations may be greater than the soil pore gas saturation concentration.

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Trichloroethylene (TCE)

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.30E+05	mg/mole
Vapor pressure	VP	=	7.61E-02	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=		ug/l
Henry's Law Constant	H	=	4.20E-01	dimensionless
Calculated soil gas concentration	C_{sg(gw)}	=	0.00E+00	mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=		mg/kg
Henry's Law Constant	H	=	4.20E-01	dimensionless
Bulk density (dry)	ρ _b	=	1.54E+00	gm/cc
Air-filled porosity	θ _a	=	1.66E-01	dimensionless
Water-filled porosity	θ _w	=	2.57E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	1.04E-01	dimensionless
Organic carbon partition coefficient	K _{oc}	=	9.40E+01	cm ³ /gm
Soil/water distribution coef.	K _d	=	9.80E+00	cm ³ /gm
Calculated soil gas concentration	C_{sg(s)}	=	0.00E+00	mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg(m)}	=	1.17E+03	mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 1.17E+03 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.23E-01	dimensionless
Air-filled porosity	θ _a	=	1.66E-01	dimensionless
Diffusion coefficient in air	D _a	=	7.90E-02	cm ² /sec
Effective diffusion coefficient	D_e	=	1.11E-03	cm²/sec
Depth of contamination or C _{sg}	X	=	3.05E+00	m
Calculated Flux	F_x	=	1.53E-01	mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m ³ /hr
Indoor air component	C_i	=	1.26E-03 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

	C _t	=	1.26E-03 mg/m ³
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EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m ³ /hr
Inhalation rate	IR	=	1.22E+01 m ³ /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
Chemical Intake (carc. risk)	IT_c	=	9.99E-05 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	2.50E-04 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	2.50E-04 mg/kg-day
Reference dose	RfD	=	1.70E-01 mg/kg-day
Hazard Index	HI	=	1.47E-03

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	9.99E-05 mg/kg-day
Slope factor (potency)	SF	=	1.00E-02 1/(mg/kg-day)
Cancer Risk	Risk	=	9.99E-07

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL
Risk Calculations

Page 1-2

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Chloroform

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	1.20E+05 mg/mole
Vapor pressure	VP	=	2.59E-01 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00 mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	ug/l
Henry's Law Constant	H	=	1.50E-01 dimensionless
Calculated soil gas concentration	C_{sg(gw)}	=	0.00E+00 mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg
Henry's Law Constant	H	=	1.50E-01 dimensionless
Bulk density (dry)	P _b	=	1.54E+00 gm/cc
Air-filled porosity	θ _a	=	1.66E-01 dimensionless
Water-filled porosity	θ _w	=	2.57E-01 dimensionless
Weight fraction of organic carbon	f _{oc}	=	1.04E-01 dimensionless
Organic carbon partition coefficient	K _{oc}	=	5.30E+01 cm ³ /gm
Soil/water distribution coef.	K _d	=	5.53E+00 cm ³ /gm
Calculated soil gas concentration	C_{sg(s)}	=	0.00E+00 mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg(m)}	=	4.87E+02 mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 4.87E+02 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.23E-01 dimensionless
Air-filled porosity	θ _a	=	1.66E-01 dimensionless
Diffusion coefficient in air	D _a	=	1.00E-01 cm ² /sec
Effective diffusion coefficient	D_e	=	1.40E-03 cm²/sec
Depth of contamination or C _{sg}	X	=	3.05E+00 m
Calculated Flux	F_x	=	8.07E-02 mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m ³ /hr
Indoor air component	C_i	=	6.61E-04 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³
C. TOTAL INDOOR AIR CONCENTRATION	C_t	=	6.61E-04 mg/m³

EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m ³ /hr
Inhalation rate	IR	=	1.22E+01 m ³ /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
Chemical Intake (carc. risk)	IT_c	=	5.26E-05 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	1.32E-04 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	1.32E-04 mg/kg-day
Reference dose	RfD	=	8.60E-02 mg/kg-day
Hazard Index	HI	=	1.53E-03

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	5.26E-05 mg/kg-day
Slope factor (potency)	SF	=	1.90E-02 1/(mg/kg-day)
Cancer Risk	Risk	=	1.00E-06

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Ethylbenzene

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.10E+05	mg/mole
Vapor pressure	VP	=	1.26E-02	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg(fp)}	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	ug/l	
Henry's Law Constant	H	=	3.20E-01	dimensionless
Calculated soil gas concentration	C_{sg(gw)}	=	0.00E+00	mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg	
Henry's Law Constant	H	=	3.20E-01	dimensionless
Bulk density (dry)	ρ _b	=	1.54E+00	gm/cc
Air-filled porosity	θ _a	=	1.66E-01	dimensionless
Water-filled porosity	θ _w	=	2.57E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	1.04E-01	dimensionless
Organic carbon partition coefficient	K _{oc}	=	2.00E+02	cm ³ /gm
Soil/water distribution coef.	K _d	=	2.09E+01	cm ³ /gm
Calculated soil gas concentration	C_{sg(s)}	=	0.00E+00	mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg(m)}	=	9.28E+05	mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 9.28E+05 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.23E-01	dimensionless
Air-filled porosity	θ _a	=	1.66E-01	dimensionless
Diffusion coefficient in air	D _a	=	7.50E-02	cm ² /sec
Effective diffusion coefficient	D_e	=	1.05E-03	cm²/sec
Depth of contamination or C _{sg}	X	=	3.05E+00	m
Calculated Flux	F_x	=	1.15E+02	mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m ³ /hr
Indoor air component	C_i	=	9.45E-01 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 9.45E-01 \text{ mg/m}^3$$

EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m ³ /hr
Inhalation rate	IR	=	1.22E+01 m ³ /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days

Chemical Intake (carc. risk)

$$IT_c = 7.52E-02 \text{ mg/kg-day}$$

Chemical Intake (non-carc. risk)

$$IT_{nc} = 1.88E-01 \text{ mg/kg-day}$$

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	1.88E-01 mg/kg-day
Reference dose	RfD	=	5.70E-01 mg/kg-day
Hazard Index	HI	=	3.30E-01

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	7.52E-02 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
Cancer Risk	Risk	=	No Slope Factor

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Methyl Ethyl Ketone

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	7.20E+04 mg/mole
Vapor pressure	VP	=	1.20E-01 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00 mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	ug/l
Henry's Law Constant	H	=	1.10E-03 dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	0.00E+00 mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg
Henry's Law Constant	H	=	1.10E-03 dimensionless
Bulk density (dry)	ρ _b	=	1.54E+00 gm/cc
Air-filled porosity	θ _a	=	1.66E-01 dimensionless
Water-filled porosity	θ _w	=	2.57E-01 dimensionless
Weight fraction of organic carbon	f _{oc}	=	1.04E-01 dimensionless
Organic carbon partition coefficient	K _{oc}	=	4.50E+00 cm ³ /gm
Soil/water distribution coef.	K _d	=	4.69E-01 cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00 mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg}(m)	=	1.90E+05 mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 1.90E+05 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.23E-01 dimensionless
Air-filled porosity	θ _a	=	1.66E-01 dimensionless
Diffusion coefficient in air	D _a	=	9.00E-02 cm ² /sec
Effective diffusion coefficient	D_e	=	1.26E-03 cm²/sec
Depth of contamination or C _{sg}	X	=	3.05E+00 m
Calculated Flux	F_x	=	2.83E+01 mg/m²-hour

Appendix B

Appendix B

Input Parameters and Model Results for Derivation of Soil Gas Screening Concentrations – Commercial/Light Industrial Scenario

SUMMARY OF SOIL GAS SCREENING CONCENTRATIONS - COMMERCIAL/LIGHT INDUSTRIAL SCENARIO
BRC Former C-6 Facility, Los Angeles, California

CAS No.	Chemical	Cancer Risk (=1.0E-06)	Hazard Index or (=3.3E-01)	Soil Gas Screening Concentration (mg/m ³)
79-01-6	Trichloroethylene (TCE)	1.0E-06	1.8E-03	2.97E+03
127-18-4	Tetrachloroethylene (PCE)	1.0E-06	1.4E-02	1.55E+03
75-09-2	Methylene Chloride	1.0E-06	7.8E-03	6.69E+03
71-55-6	1,1,1-Trichloroethane (1,1,1-TCA)	No Slope Factor	3.3E-01	9.58E+05
75-35-4	1,1-Dichloroethylene (1,1-DCE)	1.0E-06	1.8E-03	1.45E+02
156-59-2	cis-1,2-Dichloroethylene (cis 1,2-DCE)	No Slope Factor	3.3E-01	3.48E+04
156-60-5	trans-1,2-Dichloroethylene (trans-1,2-DCE)	No Slope Factor	3.3E-01	7.26E+04
75-01-4	Vinyl Chloride	1.0E-06	1.5E-03	7.89E+01
75-34-3	1,1 - Dichloroethane (1,1-DCA)	1.0E-06	3.8E-03	5.55E+03
79-00-5	1,1,2 - TCA	1.0E-06	1.3E-02	5.27E+02
71-43-2	Benzene	1.0E-06	1.8E-03	2.66E+02

Notes:

The indicated soil gas screening concentration for each chemical represents the lower of the chemical concentrations that represents a cancer risk of 1×10^{-6} or a hazard index of 0.33. For instance, the concentration associated with a cancer risk of 1×10^{-6} was chosen as the soil gas screening concentration if the hazard index associated with that concentration is less than 0.33. Alternatively, the concentration associated with an hazard index of 0.33 was chosen if that chemical does not have a cancer slope factor or if the estimated cancer risk associated with that concentration is less than 1×10^{-6} .

In some cases, calculated soil gas screening concentrations may be greater than the soil pore gas saturation concentration.

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL
Risk Calculations

Page 1-2

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Trichloroethylene (TCE)

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.30E+05	mg/mole
Vapor pressure	VP	=	7.61E-02	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	ug/l	
Henry's Law Constant	H	=	4.20E-01	dimensionless
Calculated soil gas concentration	C_{sg(gw)}	=	0.00E+00	mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg	
Henry's Law Constant	H	=	4.20E-01	dimensionless
Bulk density (dry)	ρ _b	=	1.54E+00	gm/cc
Air-filled porosity	θ _a	=	1.66E-01	dimensionless
Water-filled porosity	θ _w	=	2.57E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	1.04E-01	dimensionless
Organic carbon partition coefficient	K _{oc}	=	9.40E+01	cm ³ /gm
Soil/water distribution coef.	K _d	=	9.80E+00	cm ³ /gm
Calculated soil gas concentration	C_{sg(s)}	=	0.00E+00	mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg(m)}	=	2.97E+03	mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 2.97E+03 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.23E-01	dimensionless
Air-filled porosity	θ _a	=	1.66E-01	dimensionless
Diffusion coefficient in air	D _a	=	7.90E-02	cm ² /sec
Effective diffusion coefficient	D_e	=	1.11E-03	cm²/sec
Depth of contamination or C _{sg}	X	=	3.05E+00	m
Calculated Flux	F_x	=	3.89E-01	mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m ³ /hr
Indoor air component	C_i	=	1.92E-03 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³
C. TOTAL INDOOR AIR CONCENTRATION	C_t	=	1.92E-03 mg/m³

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m ³ /hr
Inhalation rate	IR	=	4.80E+01 m ³ /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
Chemical Intake (carc. risk)	IT_c	=	1.00E-04 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	3.00E-04 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	3.00E-04 mg/kg-day
Reference dose	RfD	=	1.70E-01 mg/kg-day
Hazard Index	HI	=	1.77E-03

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	1.00E-04 mg/kg-day
Slope factor (potency)	SF	=	1.00E-02 1/(mg/kg-day)
Cancer Risk	Risk	=	1.00E-06

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Tetrachloroethylene (PCE)

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	1.70E+05 mg/mole
Vapor pressure	VP	=	2.43E-02 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00 mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	ug/l
Henry's Law Constant	H	=	7.50E-01 dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	0.00E+00 mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg
Henry's Law Constant	H	=	7.50E-01 dimensionless
Bulk density (dry)	ρ _b	=	1.54E+00 gm/cc
Air-filled porosity	θ _a	=	1.66E-01 dimensionless
Water-filled porosity	θ _w	=	2.57E-01 dimensionless
Weight fraction of organic carbon	f _{oc}	=	1.04E-01 dimensionless
Organic carbon partition coefficient	K _{oc}	=	2.70E+02 cm ³ /gm
Soil/water distribution coef.	K _d	=	2.81E+01 cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00 mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg} (m)	=	1.55E+03 mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 1.55E+03 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.23E-01 dimensionless
Air-filled porosity	θ _a	=	1.66E-01 dimensionless
Diffusion coefficient in air	D _a	=	7.20E-02 cm ² /sec
Effective diffusion coefficient	D_e	=	1.01E-03 cm²/sec
Depth of contamination or C _{sg}	X	=	3.05E+00 m
Calculated Flux	F_x	=	1.85E-01 mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m ³ /hr
Indoor air component	C_i	=	9.13E-04 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³
C. TOTAL INDOOR AIR CONCENTRATION	C_t	=	9.13E-04 mg/m³

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m ³ /hr
Inhalation rate	IR	=	4.80E+01 m ³ /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
Chemical Intake (carc. risk)	IT_c	=	4.76E-05 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	1.43E-04 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	1.43E-04 mg/kg-day
Reference dose	RfD	=	1.00E-02 mg/kg-day
Hazard Index	HI	=	1.43E-02

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	4.76E-05 mg/kg-day
Slope factor (potency)	SF	=	2.10E-02 1/(mg/kg-day)
Cancer Risk	Risk	=	1.00E-06

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Methylene Chloride

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	8.50E+04 mg/mole
Vapor pressure	VP	=	5.72E-01 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00 mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	ug/l
Henry's Law Constant	H	=	9.00E-02 dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	0.00E+00 mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg
Henry's Law Constant	H	=	9.00E-02 dimensionless
Bulk density (dry)	ρ _b	=	1.54E+00 gm/cc
Air-filled porosity	θ _a	=	1.66E-01 dimensionless
Water-filled porosity	θ _w	=	2.57E-01 dimensionless
Weight fraction of organic carbon	f _{oc}	=	1.04E-01 dimensionless
Organic carbon partition coefficient	K _{oc}	=	1.00E+01 cm ³ /gm
Soil/water distribution coef.	K _d	=	1.04E+00 cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00 mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg} (m)	=	6.69E+03 mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 6.69E+03 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.23E-01 dimensionless
Air-filled porosity	θ _a	=	1.66E-01 dimensionless
Diffusion coefficient in air	D _a	=	1.00E-01 cm ² /sec
Effective diffusion coefficient	D_e	=	1.40E-03 cm²/sec
Depth of contamination or C _{sg}	X	=	3.05E+00 m
Calculated Flux	F_x	=	1.11E+00 mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m ³ /hr
Indoor air component	C_i	=	2.32E-01 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³
C. TOTAL INDOOR AIR CONCENTRATION	C_t	=	2.32E-01 mg/m³

EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m ³ /hr
Inhalation rate	IR	=	1.22E+01 m ³ /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
Chemical Intake (carc. risk)	IT_c	=	1.85E-02 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	4.62E-02 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	4.62E-02 mg/kg-day
Reference dose	RfD	=	1.40E-01 mg/kg-day
Hazard Index	HI	=	3.30E-01

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	1.85E-02 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
Cancer Risk	Risk	=	No Slope Factor

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: MTBE

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	8.50E+04	mg/mole
Vapor pressure	VP	=	3.29E-01	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	ug/l	
Henry's Law Constant	H	=	2.40E-02	dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	0.00E+00	mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg	
Henry's Law Constant	H	=	2.40E-02	dimensionless
Bulk density (dry)	ρ _b	=	1.54E+00	gm/cc
Air-filled porosity	θ _a	=	1.66E-01	dimensionless
Water-filled porosity	θ _w	=	2.57E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	1.04E-01	dimensionless
Organic carbon partition coefficient	K _{oc}	=	6.00E+00	cm ³ /gm
Soil/water distribution coef.	K _d	=	6.26E-01	cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00	mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg}(m)	=	3.51E+06	mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 3.51E+06 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.23E-01	dimensionless
Air-filled porosity	θ _a	=	1.66E-01	dimensionless
Diffusion coefficient in air	D _a	=	8.00E-02	cm ² /sec
Effective diffusion coefficient	D_e	=	1.12E-03	cm²/sec
Depth of contamination or C _{sg}	X	=	3.05E+00	m
Calculated Flux	F_x	=	4.65E+02	mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m ³ /hr
Indoor air component	C_i	=	3.81E+00 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³
C. TOTAL INDOOR AIR CONCENTRATION	C_t	=	3.81E+00 mg/m³

EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m ³ /hr
Inhalation rate	IR	=	1.22E+01 m ³ /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
Chemical Intake (carc. risk)	IT_c	=	3.03E-01 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	7.59E-01 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	7.59E-01 mg/kg-day
Reference dose	RfD	=	2.30E+00 mg/kg-day
Hazard Index	HI	=	3.30E-01

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	3.03E-01 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
Cancer Risk	Risk	=	No Slope Factor

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Naphthalene

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	1.30E+05 mg/mole
Vapor pressure	VP	=	1.00E-04 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00 mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	ug/l
Henry's Law Constant	H	=	2.00E-02 dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	0.00E+00 mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg
Henry's Law Constant	H	=	2.00E-02 dimensionless
Bulk density (dry)	ρ _b	=	1.54E+00 gm/cc
Air-filled porosity	θ _a	=	1.66E-01 dimensionless
Water-filled porosity	θ _w	=	2.57E-01 dimensionless
Weight fraction of organic carbon	f _{oc}	=	1.04E-01 dimensionless
Organic carbon partition coefficient	K _{oc}	=	1.20E+03 cm ³ /gm
Soil/water distribution coef.	K _d	=	1.25E+02 cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00 mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg}(m)	=	5.38E+03 mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 5.38E+03 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.23E-01 dimensionless
Air-filled porosity	θ _a	=	1.66E-01 dimensionless
Diffusion coefficient in air	D _a	=	5.90E-02 cm ² /sec
Effective diffusion coefficient	D_e	=	8.28E-04 cm²/sec
Depth of contamination or C _{sg}	X	=	3.05E+00 m
Calculated Flux	F_x	=	5.26E-01 mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m ³ /hr
Indoor air component	C_i	=	4.31E-03 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³
C. TOTAL INDOOR AIR CONCENTRATION	C_t	=	4.31E-03 mg/m³

EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m ³ /hr
Inhalation rate	IR	=	1.22E+01 m ³ /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
Chemical Intake (carc. risk)	IT_c	=	3.43E-04 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	8.57E-04 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	8.57E-04 mg/kg-day
Reference dose	RfD	=	2.60E-03 mg/kg-day
Hazard Index	HI	=	3.30E-01

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	3.43E-04 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
Cancer Risk	Risk	=	No Slope Factor

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL
Risk Calculations

Page 1-2

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Toluene

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	9.20E+04 mg/mole
Vapor pressure	VP	=	3.74E-02 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
Calculated soil gas concentration	C_{sg(fp)}	=	0.00E+00 mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	ug/l
Henry's Law Constant	H	=	2.70E-01 dimensionless
Calculated soil gas concentration	C_{sg(gw)}	=	0.00E+00 mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg
Henry's Law Constant	H	=	2.70E-01 dimensionless
Bulk density (dry)	ρ _b	=	1.54E+00 gm/cc
Air-filled porosity	θ _a	=	1.66E-01 dimensionless
Water-filled porosity	θ _w	=	2.57E-01 dimensionless
Weight fraction of organic carbon	f _{oc}	=	1.04E-01 dimensionless
Organic carbon partition coefficient	K _{oc}	=	1.40E+02 cm ³ /gm
Soil/water distribution coef.	K _d	=	1.46E+01 cm ³ /gm
Calculated soil gas concentration	C_{sg(s)}	=	0.00E+00 mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg(m)}	=	1.21E+05 mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 1.21E+05 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.23E-01 dimensionless
Air-filled porosity	θ _a	=	1.66E-01 dimensionless
Diffusion coefficient in air	D _a	=	8.70E-02 cm ² /sec
Effective diffusion coefficient	D_e	=	1.22E-03 cm²/sec
Depth of contamination or C _{sg}	X	=	3.05E+00 m
Calculated Flux	F_x	=	1.74E+01 mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m ³ /hr
Indoor air component	C_i	=	1.43E-01 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³
C. TOTAL INDOOR AIR CONCENTRATION	C_t	=	1.43E-01 mg/m³

EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m ³ /hr
Inhalation rate	IR	=	1.22E+01 m ³ /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
Chemical Intake (carc. risk)	IT_c	=	1.14E-02 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	2.84E-02 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	2.84E-02 mg/kg-day
Reference dose	RfD	=	8.60E-02 mg/kg-day
Hazard Index	HI	=	3.31E-01

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	1.14E-02 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
Cancer Risk	Risk	=	No Slope Factor

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Trichlorofluoromethane (Freon 11)

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	1.40E+05 mg/mole
Vapor pressure	VP	=	1.05E+00 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00 mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	ug/l
Henry's Law Constant	H	=	4.00E+00 dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	0.00E+00 mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg
Henry's Law Constant	H	=	4.00E+00 dimensionless
Bulk density (dry)	ρ _b	=	1.54E+00 gm/cc
Air-filled porosity	θ _a	=	1.66E-01 dimensionless
Water-filled porosity	θ _w	=	2.57E-01 dimensionless
Weight fraction of organic carbon	f _{oc}	=	1.04E-01 dimensionless
Organic carbon partition coefficient	K _{oc}	=	1.60E+02 cm ³ /gm
Soil/water distribution coef.	K _d	=	1.67E+01 cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00 mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg}(m)	=	2.81E+05 mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 2.81E+05 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.23E-01 dimensionless
Air-filled porosity	θ _a	=	1.66E-01 dimensionless
Diffusion coefficient in air	D _a	=	8.70E-02 cm ² /sec
Effective diffusion coefficient	D_e	=	1.22E-03 cm²/sec
Depth of contamination or C _{sg}	X	=	3.05E+00 m
Calculated Flux	F_x	=	4.05E+01 mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Risk Calculations

Page 2-2

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m ³ /hr
Indoor air component	C_i	=	3.32E-01 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³
C. TOTAL INDOOR AIR CONCENTRATION	C_t	=	3.32E-01 mg/m³

EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m ³ /hr
Inhalation rate	IR	=	1.22E+01 m ³ /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
Chemical Intake (carc. risk)	IT_c	=	2.64E-02 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	6.60E-02 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	6.60E-02 mg/kg-day
Reference dose	RfD	=	2.00E-01 mg/kg-day
Hazard Index	HI	=	3.30E-01

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	2.64E-02 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
Cancer Risk	Risk	=	No Slope Factor

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL
Risk Calculations

Page 1-2

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Xylenes

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	1.10E+05 mg/mole
Vapor pressure	VP	=	1.05E-02 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00 mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	ug/l
Henry's Law Constant	H	=	3.00E-01 dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	0.00E+00 mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg
Henry's Law Constant	H	=	3.00E-01 dimensionless
Bulk density (dry)	ρ _b	=	1.54E+00 gm/cc
Air-filled porosity	θ _a	=	1.66E-01 dimensionless
Water-filled porosity	θ _w	=	2.57E-01 dimensionless
Weight fraction of organic carbon	f _{oc}	=	1.04E-01 dimensionless
Organic carbon partition coefficient	K _{oc}	=	2.00E+02 cm ³ /gm
Soil/water distribution coef.	K _d	=	2.09E+01 cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00 mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg}(m)	=	3.49E+05 mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 3.49E+05 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.23E-01 dimensionless
Air-filled porosity	θ _a	=	1.66E-01 dimensionless
Diffusion coefficient in air	D _a	=	7.00E-02 cm ² /sec
Effective diffusion coefficient	D_e	=	9.82E-04 cm²/sec
Depth of contamination or C _{sg}	X	=	3.05E+00 m
Calculated Flux	F_x	=	4.05E+01 mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	Af	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m ³ /hr
Indoor air component	C_i	=	3.32E-01 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³
C. TOTAL INDOOR AIR CONCENTRATION	C_t	=	3.32E-01 mg/m³

EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m ³ /hr
Inhalation rate	IR	=	1.22E+01 m ³ /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
Chemical Intake (carc. risk)	IT_c	=	2.64E-02 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	6.60E-02 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	6.60E-02 mg/kg-day
Reference dose	RfD	=	2.00E-01 mg/kg-day
Hazard Index	HI	=	3.30E-01

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	2.64E-02 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
Cancer Risk	Risk	=	No Slope Factor

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: 1,2-Dichloroethane (EDC)

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	9.90E+04 mg/mole
Vapor pressure	VP	=	1.14E-01 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00 mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	ug/l
Henry's Law Constant	H	=	4.00E-02 dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	0.00E+00 mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg
Henry's Law Constant	H	=	4.00E-02 dimensionless
Bulk density (dry)	ρ _b	=	1.54E+00 gm/cc
Air-filled porosity	θ _a	=	1.66E-01 dimensionless
Water-filled porosity	θ _w	=	2.57E-01 dimensionless
Weight fraction of organic carbon	f _{oc}	=	1.04E-01 dimensionless
Organic carbon partition coefficient	K _{oc}	=	3.80E+01 cm ³ /gm
Soil/water distribution coef.	K _d	=	3.96E+00 cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00 mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg} (m)	=	1.32E+02 mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 1.32E+02 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.23E-01 dimensionless
Air-filled porosity	θ _a	=	1.66E-01 dimensionless
Diffusion coefficient in air	D _a	=	1.00E-01 cm ² /sec
Effective diffusion coefficient	D_e	=	1.40E-03 cm²/sec
Depth of contamination or C _{sg}	X	=	3.05E+00 m
Calculated Flux	F_x	=	2.19E-02 mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m ³ /hr
Indoor air component	C_i	=	1.79E-04 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³
C. TOTAL INDOOR AIR CONCENTRATION	C_t	=	1.79E-04 mg/m³

EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m ³ /hr
Inhalation rate	IR	=	1.22E+01 m ³ /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
Chemical Intake (carc. risk)	IT_c	=	1.43E-05 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	3.57E-05 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	3.57E-05 mg/kg-day
Reference dose	RfD	=	2.70E-02 mg/kg-day
Hazard Index	HI	=	1.32E-03

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	1.43E-05 mg/kg-day
Slope factor (potency)	SF	=	7.00E-02 1/(mg/kg-day)
Cancer Risk	Risk	=	9.98E-07

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Dichlorodifluoromethane

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	1.20E+05 mg/mole
Vapor pressure	VP	=	5.77E+00 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00 mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	ug/l
Henry's Law Constant	H	=	4.10E+00 dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	0.00E+00 mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg
Henry's Law Constant	H	=	4.10E+00 dimensionless
Bulk density (dry)	ρ _b	=	1.54E+00 gm/cc
Air-filled porosity	θ _a	=	1.66E-01 dimensionless
Water-filled porosity	θ _w	=	2.57E-01 dimensionless
Weight fraction of organic carbon	f _{oc}	=	1.04E-01 dimensionless
Organic carbon partition coefficient	K _{oc}	=	5.80E+01 cm ³ /gm
Soil/water distribution coef.	K _d	=	6.05E+00 cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00 mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg} (m)	=	8.70E+04 mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 8.70E+04 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.23E-01 dimensionless
Air-filled porosity	θ _a	=	1.66E-01 dimensionless
Diffusion coefficient in air	D _a	=	8.00E-02 cm ² /sec.
Effective diffusion coefficient	D_e	=	1.12E-03 cm²/sec
Depth of contamination or C _{sg}	X	=	3.05E+00 m
Calculated Flux	F_x	=	1.15E+01 mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m ³ /hr
Indoor air component	C_i	=	9.45E-02 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³
C. TOTAL INDOOR AIR CONCENTRATION	C_t	=	9.45E-02 mg/m³

EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m ³ /hr
Inhalation rate	IR	=	1.22E+01 m ³ /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
Chemical Intake (carc. risk)	IT_c	=	7.52E-03 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	1.88E-02 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	1.88E-02 mg/kg-day
Reference dose	RfD	=	5.70E-02 mg/kg-day
Hazard Index	HI	=	3.30E-01

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	7.52E-03 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
Cancer Risk	Risk	=	No Slope Factor

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Carbon tetrachloride

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	1.50E+05 mg/mole
Vapor pressure	VP	=	1.51E-01 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00 mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	ug/l
Henry's Law Constant	H	=	1.20E+00 dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	0.00E+00 mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg
Henry's Law Constant	H	=	1.20E+00 dimensionless
Bulk density (dry)	ρ _b	=	1.54E+00 gm/cc
Air-filled porosity	θ _a	=	1.66E-01 dimensionless
Water-filled porosity	θ _w	=	2.57E-01 dimensionless
Weight fraction of organic carbon	f _{oc}	=	1.04E-01 dimensionless
Organic carbon partition coefficient	K _{oc}	=	1.50E+02 cm ³ /gm
Soil/water distribution coef.	K _d	=	1.56E+01 cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00 mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg}(m)	=	7.91E+01 mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 7.91E+01 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.23E-01 dimensionless
Air-filled porosity	θ _a	=	1.66E-01 dimensionless
Diffusion coefficient in air	D _a	=	7.80E-02 cm ² /sec
Effective diffusion coefficient	D_e	=	1.09E-03 cm²/sec
Depth of contamination or C _{sg}	X	=	3.05E+00 m
Calculated Flux	F_x	=	1.02E-02 mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	Af	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	5.00E-01 exchanges/hr
Ventilation rate	Q	=	1.22E+00 m ³ /hr
Indoor air component	C_i	=	8.38E-05 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³
C. TOTAL INDOOR AIR CONCENTRATION	C_t	=	8.38E-05 mg/m³

EXPOSURE SCENARIO

Body weight	BW	=	5.90E+01 kg
Inhalation rate	IR	=	5.10E-01 m ³ /hr
Inhalation rate	IR	=	1.22E+01 m ³ /day
Exposure duration	ED	=	3.00E+01 yrs
Hours per day	conversion	=	2.40E+01 hr/day
Exposure time	ET	=	1.00E+00 hr/24 hours
Days per week	conversion	=	7.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	3.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	1.10E+04 days
Chemical Intake (carc. risk)	IT_c	=	6.67E-06 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	1.67E-05 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	1.67E-05 mg/kg-day
Reference dose	RfD	=	6.86E-04 mg/kg-day
Hazard Index	HI	=	2.43E-02

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	6.67E-06 mg/kg-day
Slope factor (potency)	SF	=	1.50E-01 1/(mg/kg-day)
Cancer Risk	Risk	=	1.00E-06

GEOTECHNICAL PARAMETERS

Sample ID	Date Sampled	Depth (feet bgs)	Sieve Analysis (Soil Type)	Dry Bulk Density (g/cm ³)	Moisture Content (percent by weight)	Total Porosity (fraction by volume)	Air-filled Porosity (fraction by volume)	Water-filled Porosity (fraction by volume)	TOC* (mg/kg)	f_{oc} (fraction by weight)
I-34-4.5	1/22/2001	4.5	Silt	1.87	18.9	0.31	0.05	0.26	610	0.06
EIA290176-001 (I-34-5)	1/29/2001	5	Silt	1.51	15.9	0.43	0.19	0.24	520	0.05
EIA290176-010 (D-29-5)	1/29/2001	5	Silt	1.44	20.3	0.46	0.16	0.29	2350	0.24
EIA29176-018 (I-25-5)	1/29/2001	5	Silt	1.34	17.8	0.49	0.26	0.24	690	0.07
Average				1.54						
				0.42		0.17		0.26	1043	0.10

Notes:

The air-filled porosity values were calculated from gravimetric data, not volumetric data.

* f_{oc} = the weight fraction of organic carbon in soil = TOC/10,000

CHEMICAL PARAMETERS

CAS No.	MW (mg/mole)	H ⁺ (dimension-less)	D _a (cm ² /sec)	VP (atm)	Temp. (°C)	K _{oc} (cm ³ /g)	Water Solubility (mg/l-water)	CSF (inh) (mg/kg-day) ¹	Chronic RD (inh) (mg/kg-day)
79-01-6	Trichloroethylene (TCE)	1.3E+05	a	4.2E-01	7.9E-02	a	9.4E+01	a	1.0E-02
127-18-4	Tetrachloroethylene (PCE)	1.7E+05	a	7.5E-01	7.2E-02	a	2.4E-02	b	2.1E-02
75-08-2	Methylene Chloride	8.5E+04	a	9.0E-02	1.0E-01	a	5.7E-01	b	1.1E-01
71-55-6	1,1,1-Trichloroethane (1,1,1-TCA)	1.3E+05	a	7.1E-01	7.8E-02	a	1.6E+01	a	1.3E+04
75-35-4	1,1-Dichloroethylene (1,1-DCE)	9.7E+04	a	1.1E+00	9.0E-02	a	1.4E+02	b	1.3E+03
156-59-2	cis-1,2-Dichloroethylene (cis 1,2-DCE)	9.7E+04	a	1.7E-01	7.4E-02	a	7.8E-01	b	6.5E+01
156-60-5	trans-1,2-Dichloroethylene (trans-1,2-DCE)	9.7E+04	a	3.8E-01	7.1E-02	a	2.4E-04	b	3.6E+01
75-01-4	Vinyl Chloride	6.3E+04	a	1.1E+00	1.1E-01	a	5.2E-01	b	3.8E+01
75-34-3	1,1 - Dichloroethane (1,1-DCA)	9.9E+04	a	2.3E-01	7.4E-02	a	3.5E+00	b	1.9E+01
78-00-5	1,1,2 - TCA	1.3E+05	a	3.7E-02	7.8E-02	a	3.1E-01	b	5.3E+01
71-43-2	Benzene	7.8E+04	a	2.3E-01	8.8E-02	a	1.2E-02	b	4.4E+03
67-66-3	Chloroform	1.2E+05	a	1.5E-01	1.0E-01	a	2.6E-01	b	6.2E+01
100-41-4	Ethylbenzene	1.1E+05	a	3.2E-01	7.5E-02	a	1.3E-02	b	5.3E+01
78-03-3	Methyl Ethyl Ketone	7.2E+04	a	1.1E-03	9.0E-02	a	1.2E-01	b	2.0E+02
1634-04-4	MTBE	8.5E+04	a	2.4E-02	8.0E-02	a	3.3E-01	b	4.4E+03
91-20-3	Naphthalene	1.3E+05	a	2.0E-02	5.9E-02	a	1.0E-04	b	1.8E+03
108-88-3	Toluene	9.2E+04	a	2.7E-01	8.7E-02	a	3.7E-02	b	5.3E+03
75-09-4	Trichlorofluoromethane (Freon 11)	1.4E+05	a	4.0E+00	8.7E-02	a	1.0E+02	b	1.7E+02
1330-20-7	Xylenes	1.1E+05	a	3.0E-01	7.0E-02	a	1.1E-02	b	4.5E+00
107-06-2	1,2-Dichloroethane (EDC)	9.9E+04	a	4.0E-02	1.0E-01	a	1.1E-01	b	2.0E+02
75-71-8	Dichlorodifluoromethane	1.2E+05	a	4.1E+00	8.0E-02	a	5.8E+00	b	3.8E+01
56-23-5	Carbon tetrachloride	1.5E+05	a	1.2E+00	7.8E-02	a	1.5E-01	b	2.8E+02

References:

- a EPA Region 9, Preliminary Remediation Goals (PRGs), 2000.
 b U.S. National Library of Medicine Hazardous Substance Data Bank (HSDB), <http://www.nlm.nih.gov/pubs/factsheets/hsdbfs.html>
 c Cal-EPA Office of Environmental Health Hazard Assessment (OEHHHA), Toxicity Criteria Database and December 2000 California Cancer Potency Values, <http://www.oehha.ca.gov/risk/chemicalDB/index.asp>
 d Risk Assessment Information System (RAIS) Toxicity & Chemical-Specific Factors Data Base, January 2001, http://risk.lsd.ornl.gov/cgi-bin/toxTOX_select?select=csf
 e Cal-EPA, Air Resources Board (ARB), Consolidated Table of OEHHHA/ARB Approved Risk Assessment Health Values, October 10, 2000, <http://www.arb.ca.gov/rab2588/riskassess.htm>
- Toxicity Value reference priority:
 1. Cal-EPA Office of Environmental Health Hazard Assessment (OEHHHA), Toxicity Criteria Database and December 2000 California Cancer Potency Values, <http://www.oehha.ca.gov/risk/chemicalDB/index.asp>
 2. Cal-EPA, Air Resources Board (ARB), Consolidated Table of OEHHHA/ARB Approved Risk Assessment Health Values, October 10, 2000, <http://www.arb.ca.gov/rab2588/riskassess.htm>
 3. EPA Region 9, Preliminary Remediation Goals (PRGs), 2000.

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m ³ /hr
Indoor air component	C_i	=	5.47E-03 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

	C _t	=	5.47E-03 mg/m ³
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EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m ³ /hr
Inhalation rate	IR	=	4.80E+01 m ³ /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
Chemical Intake (carc. risk)	IT_c	=	2.86E-04 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	8.57E-04 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	8.57E-04 mg/kg-day
Reference dose	RfD	=	1.10E-01 mg/kg-day
Hazard Index	HI	=	7.79E-03

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	2.86E-04 mg/kg-day
Slope factor (potency)	SF	=	3.50E-03 1/(mg/kg-day)
Cancer Risk	Risk	=	1.00E-06

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: 1,1,1-Trichloroethane (1,1,1-TCA)

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	1.30E+05 mg/mole
Vapor pressure	VP	=	1.63E-01 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00 mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	ug/l
Henry's Law Constant	H	=	7.10E-01 dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	0.00E+00 mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg
Henry's Law Constant	H	=	7.10E-01 dimensionless
Bulk density (dry)	ρ _b	=	1.54E+00 gm/cc
Air-filled porosity	θ _a	=	1.66E-01 dimensionless
Water-filled porosity	θ _w	=	2.57E-01 dimensionless
Weight fraction of organic carbon	f _{oc}	=	1.04E-01 dimensionless
Organic carbon partition coefficient	K _{oc}	=	1.40E+02 cm ³ /gm
Soil/water distribution coef.	K _d	=	1.46E+01 cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00 mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg} (m)	=	9.58E+05 mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 9.58E+05 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.23E-01 dimensionless
Air-filled porosity	θ _a	=	1.66E-01 dimensionless
Diffusion coefficient in air	D _a	=	7.80E-02 cm ² /sec
Effective diffusion coefficient	D_e	=	1.09E-03 cm²/sec
Depth of contamination or C _{sg}	X	=	3.05E+00 m
Calculated Flux	F_x	=	1.24E+02 mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m ³ /hr
Indoor air component	C_i	=	6.11E-01 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³
C. TOTAL INDOOR AIR CONCENTRATION	C_t	=	6.11E-01 mg/m³

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m ³ /hr
Inhalation rate	IR	=	4.80E+01 m ³ /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
Chemical Intake (carc. risk)	IT_c	=	3.19E-02 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	9.57E-02 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	9.57E-02 mg/kg-day
Reference dose	RfD	=	2.90E-01 mg/kg-day
Hazard Index	HI	=	3.30E-01

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	3.19E-02 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
Cancer Risk	Risk	=	No Slope Factor

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL
Risk Calculations

Page 1-2

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: 1,1-Dichloroethylene (1,1-DCE)

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	9.70E+04 mg/mole
Vapor pressure	VP	=	7.78E-01 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00 mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	ug/l
Henry's Law Constant	H	=	1.10E+00 dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	0.00E+00 mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg
Henry's Law Constant	H	=	1.10E+00 dimensionless
Bulk density (dry)	ρ _b	=	1.54E+00 gm/cc
Air-filled porosity	θ _a	=	1.66E-01 dimensionless
Water-filled porosity	θ _w	=	2.57E-01 dimensionless
Weight fraction of organic carbon	f _{oc}	=	1.04E-01 dimensionless
Organic carbon partition coefficient	K _{oc}	=	6.50E+01 cm ³ /gm
Soil/water distribution coef.	K _d	=	6.78E+00 cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00 mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg}(m)	=	1.45E+02 mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 1.45E+02 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.23E-01 dimensionless
Air-filled porosity	θ _a	=	1.66E-01 dimensionless
Diffusion coefficient in air	D _a	=	9.00E-02 cm ² /sec
Effective diffusion coefficient	D_e	=	1.26E-03 cm²/sec
Depth of contamination or C _{sg}	X	=	3.05E+00 m
Calculated Flux	F_x	=	2.16E-02 mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Risk Calculations

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Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m ³ /hr
Indoor air component	C_i	=	1.07E-04 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 1.07E-04 \text{ mg/m}^3$$

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m ³ /hr
Inhalation rate	IR	=	4.80E+01 m ³ /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
Chemical Intake (carc. risk)	IT_c	=	5.57E-06 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	1.67E-05 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	1.67E-05 mg/kg-day
Reference dose	RfD	=	9.10E-03 mg/kg-day
Hazard Index	HI	=	1.84E-03

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	5.57E-06 mg/kg-day
Slope factor (potency)	SF	=	1.80E-01 1/(mg/kg-day)
Cancer Risk	Risk	=	1.00E-06

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: cis-1,2-Dichloroethylene (cis 1,2-DCE)

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	9.70E+04 mg/mole
Vapor pressure	VP	=	2.40E-04 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
Calculated soil gas concentration	C_{sg(fp)}	=	0.00E+00 mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	ug/l
Henry's Law Constant	H	=	1.70E-01 dimensionless
Calculated soil gas concentration	C_{sg(gw)}	=	0.00E+00 mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg
Henry's Law Constant	H	=	1.70E-01 dimensionless
Bulk density (dry)	ρ _b	=	1.54E+00 gm/cc
Air-filled porosity	θ _a	=	1.66E-01 dimensionless
Water-filled porosity	θ _w	=	2.57E-01 dimensionless
Weight fraction of organic carbon	f _{oc}	=	1.04E-01 dimensionless
Organic carbon partition coefficient	K _{oc}	=	3.60E+01 cm ³ /gm
Soil/water distribution coef.	K _d	=	3.75E+00 cm ³ /gm
Calculated soil gas concentration	C_{sg(s)}	=	0.00E+00 mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg(m)}	=	3.48E+04 mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 3.48E+04 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.23E-01 dimensionless
Air-filled porosity	θ _a	=	1.66E-01 dimensionless
Diffusion coefficient in air	D _a	=	7.40E-02 cm ² /sec
Effective diffusion coefficient	D_e	=	1.04E-03 cm²/sec
Depth of contamination or C _{sg}	X	=	3.05E+00 m
Calculated Flux	F_x	=	4.27E+00 mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m ³ /hr
Indoor air component	C_i	=	2.11E-02 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³
C. TOTAL INDOOR AIR CONCENTRATION	C_t	=	2.11E-02 mg/m³

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m ³ /hr
Inhalation rate	IR	=	4.80E+01 m ³ /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
Chemical Intake (carc. risk)	IT_c	=	1.10E-03 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	3.30E-03 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	3.30E-03 mg/kg-day
Reference dose	RfD	=	1.00E-02 mg/kg-day
Hazard Index	HI	=	3.30E-01

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	1.10E-03 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
Cancer Risk	Risk	=	No Slope Factor

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL
Risk Calculations

Page 1-2

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: trans-1,2-Dichloroethylene (trans-1,2-DCE)

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	9.70E+04	mg/mole
Vapor pressure	VP	=	5.20E-01	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	ug/l	
Henry's Law Constant	H	=	3.80E-01	dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	0.00E+00	mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg	
Henry's Law Constant	H	=	3.80E-01	dimensionless
Bulk density (dry)	ρ _b	=	1.54E+00	gm/cc
Air-filled porosity	θ _a	=	1.66E-01	dimensionless
Water-filled porosity	θ _w	=	2.57E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	1.04E-01	dimensionless
Organic carbon partition coefficient	K _{oc}	=	3.80E+01	cm ³ /gm
Soil/water distribution coef.	K _d	=	3.96E+00	cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00	mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg}(m)	=	7.26E+04	mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 7.26E+04 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.23E-01	dimensionless
Air-filled porosity	θ _a	=	1.66E-01	dimensionless
Diffusion coefficient in air	D _a	=	7.10E-02	cm ² /sec
Effective diffusion coefficient	D_e	=	9.96E-04	cm²/sec
Depth of contamination or C _{sg}	X	=	3.05E+00	m
Calculated Flux	F_x	=	8.54E+00	mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m ³ /hr
Indoor air component	C_i	=	4.22E-02 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³
C. TOTAL INDOOR AIR CONCENTRATION	C_t	=	4.22E-02 mg/m³

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m ³ /hr
Inhalation rate	IR	=	4.80E+01 m ³ /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
Chemical Intake (carc. risk)	IT_c	=	2.20E-03 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	6.60E-03 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	6.60E-03 mg/kg-day
Reference dose	RfD	=	2.00E-02 mg/kg-day
Hazard Index	HI	=	3.30E-01

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	2.20E-03 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
Cancer Risk	Risk	=	No Slope Factor

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Vinyl Chloride

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	6.30E+04 mg/mole
Vapor pressure	VP	=	3.50E+00 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
Calculated soil gas concentration	C_{sg(fp)}	=	0.00E+00 mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	ug/l
Henry's Law Constant	H	=	1.10E+00 dimensionless
Calculated soil gas concentration	C_{sg(gw)}	=	0.00E+00 mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg
Henry's Law Constant	H	=	1.10E+00 dimensionless
Bulk density (dry)	ρ _b	=	1.54E+00 gm/cc
Air-filled porosity	θ _a	=	1.66E-01 dimensionless
Water-filled porosity	θ _w	=	2.57E-01 dimensionless
Weight fraction of organic carbon	f _{oc}	=	1.04E-01 dimensionless
Organic carbon partition coefficient	K _{oc}	=	1.90E+01 cm ³ /gm
Soil/water distribution coef.	K _d	=	1.98E+00 cm ³ /gm
Calculated soil gas concentration	C_{sg(s)}	=	0.00E+00 mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg(m)}	=	7.89E+01 mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 7.89E+01 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.23E-01 dimensionless
Air-filled porosity	θ _a	=	1.66E-01 dimensionless
Diffusion coefficient in air	D _a	=	1.10E-01 cm ² /sec
Effective diffusion coefficient	D_e	=	1.54E-03 cm²/sec
Depth of contamination or C _{sg}	X	=	3.05E+00 m
Calculated Flux	F_x	=	1.44E-02 mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m ³ /hr
Indoor air component	C_i	=	7.10E-05 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³
C. TOTAL INDOOR AIR CONCENTRATION	C_t	=	7.10E-05 mg/m³

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m ³ /hr
Inhalation rate	IR	=	4.80E+01 m ³ /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
Chemical Intake (carc. risk)	IT_c	=	3.70E-06 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	1.11E-05 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	1.11E-05 mg/kg-day
Reference dose	RfD	=	7.43E-03 mg/kg-day
Hazard Index	HI	=	1.50E-03

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	3.70E-06 mg/kg-day
Slope factor (potency)	SF	=	2.70E-01 1/(mg/kg-day)
Cancer Risk	Risk	=	1.00E-06

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: 1,1 - Dichloroethane (1,1-DCA)

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	9.90E+04 mg/mole
Vapor pressure	VP	=	3.08E-01 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00 mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	ug/l
Henry's Law Constant	H	=	2.30E-01 dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	0.00E+00 mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg
Henry's Law Constant	H	=	2.30E-01 dimensionless
Bulk density (dry)	ρ _b	=	1.54E+00 gm/cc
Air-filled porosity	θ _a	=	1.66E-01 dimensionless
Water-filled porosity	θ _w	=	2.57E-01 dimensionless
Weight fraction of organic carbon	f _{oc}	=	1.04E-01 dimensionless
Organic carbon partition coefficient	K _{oc}	=	5.30E+01 cm ³ /gm
Soil/water distribution coef.	K _d	=	5.53E+00 cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00 mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg} (m)	=	5.55E+03 mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 5.55E+03 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.23E-01 dimensionless
Air-filled porosity	θ _a	=	1.66E-01 dimensionless
Diffusion coefficient in air	D _a	=	7.40E-02 cm ² /sec
Effective diffusion coefficient	D_e	=	1.04E-03 cm²/sec
Depth of contamination or C _{sg}	X	=	3.05E+00 m
Calculated Flux	F_x	=	6.80E-01 mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m ³ /hr
Indoor air component	C_i	=	3.36E-03 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³
C. TOTAL INDOOR AIR CONCENTRATION	C_t	=	3.36E-03 mg/m³

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m ³ /hr
Inhalation rate	IR	=	4.80E+01 m ³ /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
Chemical Intake (carc. risk)	IT_c	=	1.75E-04 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	5.26E-04 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	5.26E-04 mg/kg-day
Reference dose	RfD	=	1.40E-01 mg/kg-day
Hazard Index	HI	=	3.76E-03

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	1.75E-04 mg/kg-day
Slope factor (potency)	SF	=	5.70E-03 1/(mg/kg-day)
Cancer Risk	Risk	=	9.99E-07

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: 1,1,2 - TCA

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	1.30E+05 mg/mole
Vapor pressure	VP	=	3.10E-02 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00 mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	ug/l
Henry's Law Constant	H	=	3.70E-02 dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	0.00E+00 mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg
Henry's Law Constant	H	=	3.70E-02 dimensionless
Bulk density (dry)	ρ _b	=	1.54E+00 gm/cc
Air-filled porosity	θ _a	=	1.66E-01 dimensionless
Water-filled porosity	θ _w	=	2.57E-01 dimensionless
Weight fraction of organic carbon	f _{oc}	=	1.04E-01 dimensionless
Organic carbon partition coefficient	K _{oc}	=	7.50E+01 cm ³ /gm
Soil/water distribution coef.	K _d	=	7.82E+00 cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00 mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg}(m)	=	5.27E+02 mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 5.27E+02 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.23E-01 dimensionless
Air-filled porosity	θ _a	=	1.66E-01 dimensionless
Diffusion coefficient in air	D _a	=	7.80E-02 cm ² /sec
Effective diffusion coefficient	D_e	=	1.09E-03 cm²/sec
Depth of contamination or C _{sg}	X	=	3.05E+00 m
Calculated Flux	F_x	=	6.81E-02 mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m ³ /hr
Indoor air component	C_i	=	3.36E-04 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³
C. TOTAL INDOOR AIR CONCENTRATION	C_t	=	3.36E-04 mg/m³

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m ³ /hr
Inhalation rate	IR	=	4.80E+01 m ³ /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
Chemical Intake (carc. risk)	IT_c	=	1.75E-05 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	5.26E-05 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	5.26E-05 mg/kg-day
Reference dose	RfD	=	4.00E-03 mg/kg-day
Hazard Index	HI	=	1.32E-02

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	1.75E-05 mg/kg-day
Slope factor (potency)	SF	=	5.70E-02 1/(mg/kg-day)
Cancer Risk	Risk	=	1.00E-06

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL
Risk Calculations

Page 1-2

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Benzene

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	7.80E+04	mg/mole
Vapor pressure	VP	=	1.25E-01	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg(fp)}	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	ug/l	
Henry's Law Constant	H	=	2.30E-01	dimensionless
Calculated soil gas concentration	C_{sg(gw)}	=	0.00E+00	mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg	
Henry's Law Constant	H	=	2.30E-01	dimensionless
Bulk density (dry)	ρ _b	=	1.54E+00	gm/cc
Air-filled porosity	θ _a	=	1.66E-01	dimensionless
Water-filled porosity	θ _w	=	2.57E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	1.04E-01	dimensionless
Organic carbon partition coefficient	K _{oc}	=	6.20E+01	cm ³ /gm
Soil/water distribution coef.	K _d	=	6.46E+00	cm ³ /gm
Calculated soil gas concentration	C_{sg(s)}	=	0.00E+00	mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg(m)}	=	2.66E+02	mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 2.66E+02 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.23E-01	dimensionless
Air-filled porosity	θ _a	=	1.66E-01	dimensionless
Diffusion coefficient in air	D _a	=	8.80E-02	cm ² /sec
Effective diffusion coefficient	D_e	=	1.23E-03	cm²/sec
Depth of contamination or C _{sg}	X	=	3.05E+00	m
Calculated Flux	F_x	=	3.88E-02	mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m ³ /hr
Indoor air component	C_i	=	1.91E-04 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³
C. TOTAL INDOOR AIR CONCENTRATION	C_t	=	1.91E-04 mg/m³

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m ³ /hr
Inhalation rate	IR	=	4.80E+01 m ³ /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
Chemical Intake (carc. risk)	IT_c	=	9.99E-06 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	3.00E-05 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	3.00E-05 mg/kg-day
Reference dose	RfD	=	1.70E-02 mg/kg-day
Hazard Index	HI	=	1.76E-03

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	9.99E-06 mg/kg-day
Slope factor (potency)	SF	=	1.00E-01 1/(mg/kg-day)
Cancer Risk	Risk	=	9.99E-07

GEOTECHNICAL PARAMETERS

Sample ID	Date Sampled	Depth (feet bgs)	Sieve Analysis (Soil Type)	Dry Bulk Density (g/cm ³)	Moisture Content (percent by weight)	Total Porosity (fraction by volume)	Air-filled Porosity (fraction by volume)	Water-filled Porosity (fraction by volume)	TOC* (mg/kg)	f _{oc} (fraction by weight)
I-34-4.5	1/22/2001	4.5	Silt	1.87	18.9	0.31	0.05	0.26	610	0.06
EIA290176-001 (I-34-5)	1/29/2001	5	Silt	1.51	15.9	0.43	0.19	0.24	520	0.05
EIA290176-010 (D-29-5)	1/29/2001	5	Silt	1.44	20.3	0.46	0.16	0.29	2350	0.24
EIA29176-018 (I-25-5)	1/29/2001	5	Silt	1.34	17.8	0.49	0.26	0.24	690	0.07
Average				1.54						
					0.42	0.17	0.26	0.1043	0.10	

Notes:

The air-filled porosity values were calculated from gravimetric data, not volumetric data.

* f_{oc} = the weight fraction of organic carbon in soil = TOC/10,000

CHEMICAL PARAMETERS

CAS No.		MW (mg/mole)	H' (dimension-less)	Da (cm ² /sec)	VP (atm)	Temp. (°C)	K _{oc} (cm ³ /g)	Water Solubility (mg/L-water)	CSF (inh) (mg/kg-day) ⁻¹	Chronic RfD (inh) (mg/kg-day)								
79-01-6	Trichloroethylene (TCE)	1.3E+05	a	4.2E-01	a	7.9E-02	20	b	9.4E-01	a	1.1E+03	a	1.0E-02	c	1.7E-01	e		
127-18-4	Tetrachloroethylene (PCE)	1.7E+05	a	7.5E-01	a	7.2E-02	25	b	2.4E-02	a	2.0E+02	a	2.1E-02	c	1.0E-02	e		
75-09-2	Methylene Chloride	8.5E+04	a	9.0E-02	a	1.0E-01	25	b	1.0E+01	a	1.3E+04	a	3.5E-03	c	1.1E-01	e		
71-55-6	1,1,1-Trichloroethane (1,1,1-TCA)	1.3E+05	a	7.1E-01	a	7.8E-02	25	b	1.4E+02	a	1.3E+03	a	na	a,c	2.9E-01	e		
75-35-4	1,1-Dichloroethylene (1,1-DCE)	9.7E+04	a	1.1E+00	a	9.0E-02	25	b	6.5E+01	a	2.3E+03	a	1.8E-01	a	9.1E-03	e		
156-59-2	cis-1,2-Dichloroethylene (cis 1,2-DCE)	9.7E+04	a	1.7E-01	a	7.4E-02	20	b	3.6E+01	a	3.5E+03	a	na	a,c	1.0E-02	a		
156-60-5	trans-1,2-Dichloroethylene (trans-1,2-DCE)	9.7E+04	a	3.8E-01	a	7.1E-02	30	b	5.2E+01	a	6.3E+03	a	na	a,c	2.0E-02	a		
75-01-4	Vinyl Chloride	6.3E+04	a	1.1E+00	a	1.1E+01	25	b	3.5E+00	a	1.9E+01	a	2.80E+03	a	2.7E-01	c	7.4E-03	e
75-34-3	1,1 - Dichloroethane (1,1-DCA)	9.9E+04	a	2.3E-01	a	7.4E-02	31	b	3.1E+01	a	5.3E+03	a	5.1E+03	a	5.7E-03	c	1.4E-01	a
79-00-5	1,1,2 - TCA	1.3E+05	a	3.7E-02	a	7.8E-02	25	b	3.1E-02	a	4.4E+03	a	5.7E-02	c	4.0E-03	a		
71-43-2	Benzene	7.8E+04	a	2.3E-01	a	8.8E-02	25	b	1.2E+01	a	6.2E+01	a	1.8E+03	a	1.0E-01	c	1.7E-02	e
67-66-3	Chloroform	1.2E+05	a	1.5E-01	a	1.0E-01	25	b	2.6E+01	a	5.3E+01	a	7.9E+03	a	1.9E-02	c	8.6E-02	e
100-41-4	Ethylbenzene	1.1E+05	a	3.2E-01	a	7.5E-02	25	b	1.3E-02	a	2.0E+02	a	1.7E+02	a	na	a,c	5.7E-01	e
78-93-3	Methyl Ethyl Ketone	7.8E+04	a	1.1E-03	a	9.0E-02	25	b	1.2E-01	a	4.5E+00	a	2.7E+05	a	na	a,c	1.4E-01	c
1634-04-4	MTBE	8.5E+04	a	2.4E-02	a	8.0E-02	25	b	3.3E-01	a	6.0E+00	a	1.5E+05	a	na	a,c	2.3E-00	e
91-20-3	Naphthalene	1.3E+05	a	2.0E-02	a	5.9E-02	25	b	1.0E-04	a	1.2E+03	a	3.1E+01	a	na	a,c	2.6E-03	e
108-88-3	Toluene	9.2E+04	a	2.7E-01	a	8.7E-02	25	b	3.7E-02	a	1.4E+02	a	5.3E+02	a	na	a,c	8.6E-02	e
75-69-4	Trichlorofluoromethane (Freon 11)	1.4E+05	a	4.0E+00	a	8.7E-02	25	b	1.0E+00	a	1.6E+02	a	1.1E+03	a	na	a,c	2.0E-01	e
1330-20-7	Xylenes	1.1E+05	a	3.0E-01	a	7.0E-02	25	b	1.1E-02	a	2.0E+02	a	1.6E+02	a	na	a,c	2.0E-01	e
107-06-2	1,2-Dichloroethane (EDC)	9.9E+04	a	4.0E-02	a	1.0E-01	25	b	3.8E+01	a	8.5E+03	a	7.0E-02	c	2.7E-02	e		
75-71-8	Dichlorodifluoromethane	1.2E+05	a	4.1E+00	a	8.0E-02	21	b	5.8E+01	a	2.8E+02	a	na	a,c	5.7E-02	a		
56-23-5	Carbon tetrachloride	1.5E+05	a	1.2E+00	a	7.8E-02	25	b	1.5E-01	a	1.5E+02	a	7.9E+02	a	1.5E-01	c	6.9E-04	e

References:

a EPA Region 9, Preliminary Remediation Goals (PRGs), 2000.

b U.S. National Library of Medicine Hazardous Substance Data Bank (HSDB), <http://www.nlm.nih.gov/pubs/factsheets/hsdbfs.html>

c Cal-EPA Office of Environmental Health Hazard Assessment (OEHHA), Toxicity Criteria Database and December 2000 California Cancer Potency Values, <http://www.oehha.ca.gov/risk/chemicalDB/index.asp>

d Risk Assessment Information System (RAIS) Toxicity & Chemical-Specific Factors Data Base, January 2001, http://risk.lsd.orri.gov/cgi-bin/tox/TOX_select?select=csf

e Cal-EPA, Air Resources Board (ARB), Approved Risk Assessment Health Values, October 10, 2000, <http://www.arb.ca.gov/ab2588/risksassess.htm>

Toxicity Value reference priority:

1. Cal-EPA Office of Environmental Health Hazard Assessment (OEHHA), Toxicity Criteria Database and December 2000 California Cancer Potency Values, <http://www.oehha.ca.gov/risk/chemicalDB/index.asp>

2. Cal-EPA, Air Resources Board (ARB), Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values, October 10, 2000, <http://www.arb.ca.gov/ab2588/risksassess.htm>

3. EPA Region 9, Preliminary Remediation Goals (PRGs), 2000.

SUMMARY OF PRELIMINARY SOIL GAS SCREENING CONCENTRATIONS - COMMERCIAL/LIGHT INDUSTRIAL SCENARIO
BRC Former C-6 Facility, Los Angeles, California

CAS No.	Chemical	Cancer Risk (=1.0E-06)	Hazard Index or (=3.3E-01)	Preliminary Soil Gas Screening Concentration (mg/m ³)
79-01-6	Trichloroethylene (TCE)	1.0E-06	1.8E-03	2.97E+03
67-66-3	Chloroform	1.0E-06	1.8E-03	1.23E+03
100-41-4	Ethylbenzene	No Slope Factor	3.3E-01	1.96E+06
78-93-3	Methyl Ethyl Ketone	No Slope Factor	3.3E-01	4.01E+05
1634-04-4	MTBE	No Slope Factor	3.3E-01	7.41E+06
91-20-3	Naphthalene	No Slope Factor	3.3E-01	1.14E+04
108-88-3	Toluene	No Slope Factor	3.3E-01	2.55E+05
75-69-4	Trichlorofluoromethane (Freon 11)	No Slope Factor	3.3E-01	5.92E+05
1330-20-7	Xylenes	No Slope Factor	3.3E-01	7.36E+05
107-06-2	1,2-Dichloroethane (EDC)	1.0E-06	1.6E-03	3.35E+02
75-71-8	Dichlorodifluoromethane	No Slope Factor	3.3E-01	1.84E+05
56-23-5	Carbon tetrachloride	1.0E-06	2.9E-02	2.00E+02

Notes:

The indicated preliminary soil gas screening concentration for each chemical represents the lower of the chemical concentrations that represents a cancer risk of 1×10^{-6} or a hazard index of 0.33. For instance, the concentration associated with a cancer risk of 1×10^{-6} was chosen as the preliminary soil gas screening concentration if the hazard index associated with that concentration is less than 0.33. Alternatively, the concentration associated with an hazard index of 0.33 was chosen if that chemical does not have a cancer slope factor or if the estimated cancer risk associated with that concentration is less than 1×10^{-6} .

In some cases, calculated preliminary soil gas screening concentrations may be greater than the soil pore gas saturation concentration.

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL
Risk Calculations

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Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Trichloroethylene (TCE)

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.30E+05	mg/mole
Vapor pressure	VP	=	7.61E-02	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	ug/l	
Henry's Law Constant	H	=	4.20E-01	dimensionless
Calculated soil gas concentration	C_{sg(gw)}	=	0.00E+00	mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg	
Henry's Law Constant	H	=	4.20E-01	dimensionless
Bulk density (dry)	ρ _b	=	1.54E+00	gm/cc
Air-filled porosity	θ _a	=	1.66E-01	dimensionless
Water-filled porosity	θ _w	=	2.57E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	1.04E-01	dimensionless
Organic carbon partition coefficient	K _{oc}	=	9.40E+01	cm ³ /gm
Soil/water distribution coef.	K _d	=	9.80E+00	cm ³ /gm
Calculated soil gas concentration	C_{sg(s)}	=	0.00E+00	mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg(m)}	=	2.97E+03	mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 2.97E+03 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.23E-01	dimensionless
Air-filled porosity	θ _a	=	1.66E-01	dimensionless
Diffusion coefficient in air	D _a	=	7.90E-02	cm ² /sec
Effective diffusion coefficient	D_e	=	1.11E-03	cm²/sec
Depth of contamination or C _{sg}	X	=	3.05E+00	m
Calculated Flux	F_x	=	3.89E-01	mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m ³ /hr
Indoor air component	C_i	=	1.92E-03 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³
C. TOTAL INDOOR AIR CONCENTRATION	C_t	=	1.92E-03 mg/m³

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m ³ /hr
Inhalation rate	IR	=	4.80E+01 m ³ /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
Chemical Intake (carc. risk)	IT_c	=	1.00E-04 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	3.00E-04 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	3.00E-04 mg/kg-day
Reference dose	RfD	=	1.70E-01 mg/kg-day
Hazard Index	HI	=	1.77E-03

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	1.00E-04 mg/kg-day
Slope factor (potency)	SF	=	1.00E-02 1/(mg/kg-day)
Cancer Risk	Risk	=	1.00E-06

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California**Chemical:** Chloroform

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION**A. SOURCE - Free Product/Soil>100mg/kg.**

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.20E+05	mg/mole
Vapor pressure	VP	=	2.59E-01	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	ug/l	
Henry's Law Constant	H	=	1.50E-01	dimensionless
Calculated soil gas concentration	C_{sg(gw)}	=	0.00E+00	mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg	
Henry's Law Constant	H	=	1.50E-01	dimensionless
Bulk density (dry)	ρ _b	=	1.54E+00	gm/cc
Air-filled porosity	θ _a	=	1.66E-01	dimensionless
Water-filled porosity	θ _w	=	2.57E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	1.04E-01	dimensionless
Organic carbon partition coefficient	K _{oc}	=	5.30E+01	cm ³ /gm
Soil/water distribution coef.	K _d	=	5.53E+00	cm ³ /gm
Calculated soil gas concentration	C_{sg(s)}	=	0.00E+00	mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg(m)}	=	1.23E+03	mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 1.23E+03 mg/m3**DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE**

Total porosity	θ	=	4.23E-01	dimensionless
Air-filled porosity	θ _a	=	1.66E-01	dimensionless
Diffusion coefficient in air	D _a	=	1.00E-01	cm ² /sec
Effective diffusion coefficient	D_e	=	1.40E-03	cm²/sec
Depth of contamination or C _{sg}	X	=	3.05E+00	m
Calculated Flux	F_x	=	2.04E-01	mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m ³ /hr
Indoor air component	C_i	=	1.01E-03 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³
C. TOTAL INDOOR AIR CONCENTRATION	C_t	=	1.01E-03 mg/m³

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m ³ /hr
Inhalation rate	IR	=	4.80E+01 m ³ /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
Chemical Intake (carc. risk)	IT_c	=	5.25E-05 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	1.58E-04 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	1.58E-04 mg/kg-day
Reference dose	RfD	=	8.60E-02 mg/kg-day
Hazard Index	HI	=	1.83E-03

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	5.25E-05 mg/kg-day
Slope factor (potency)	SF	=	1.90E-02 1/(mg/kg-day)
Cancer Risk	Risk	=	9.98E-07

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Ethylbenzene

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	1.10E+05 mg/mole
Vapor pressure	VP	=	1.26E-02 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00 mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	3.47E+09 ug/l
Henry's Law Constant	H	=	3.20E-01 dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	1.11E+09 mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg
Henry's Law Constant	H	=	3.20E-01 dimensionless
Bulk density (dry)	ρ _b	=	1.54E+00 gm/cc
Air-filled porosity	θ _a	=	1.66E-01 dimensionless
Water-filled porosity	θ _w	=	2.57E-01 dimensionless
Weight fraction of organic carbon	f _{oc}	=	1.04E-01 dimensionless
Organic carbon partition coefficient	K _{oc}	=	2.00E+02 cm ³ /gm
Soil/water distribution coef.	K _d	=	2.09E+01 cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00 mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg}(m)	=	1.96E+06 mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 1.96E+06 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.23E-01 dimensionless
Air-filled porosity	θ _a	=	1.66E-01 dimensionless
Diffusion coefficient in air	D _a	=	7.50E-02 cm ² /sec
Effective diffusion coefficient	D_e	=	1.05E-03 cm²/sec
Depth of contamination or C _{sg}	X	=	3.05E+00 m
Calculated Flux	F_x	=	2.44E+02 mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m ³ /hr
Indoor air component	C_i	=	1.20E+00 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

	C _t	=	1.20E+00 mg/m ³
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EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m ³ /hr
Inhalation rate	IR	=	4.80E+01 m ³ /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
Chemical Intake (carc. risk)	IT_c	=	6.28E-02 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	1.88E-01 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	1.88E-01 mg/kg-day
Reference dose	RfD	=	5.70E-01 mg/kg-day
Hazard Index	HI	=	3.30E-01

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	6.28E-02 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
Cancer Risk	Risk	=	No Slope Factor

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Methyl Ethyl Ketone

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	7.20E+04	mg/mole
Vapor pressure	VP	=	1.20E-01	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	ug/l
Henry's Law Constant	H	=	1.10E-03 dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	0.00E+00 mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg
Henry's Law Constant	H	=	1.10E-03 dimensionless
Bulk density (dry)	ρ _b	=	1.54E+00 gm/cc
Air-filled porosity	θ _a	=	1.66E-01 dimensionless
Water-filled porosity	θ _w	=	2.57E-01 dimensionless
Weight fraction of organic carbon	f _{oc}	=	1.04E-01 dimensionless
Organic carbon partition coefficient	K _{oc}	=	4.50E+00 cm ³ /gm
Soil/water distribution coef.	K _d	=	4.69E-01 cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00 mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg}(m)	=	4.01E+05 mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 4.01E+05 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.23E-01	dimensionless
Air-filled porosity	θ _a	=	1.66E-01	dimensionless
Diffusion coefficient in air	D _a	=	9.00E-02	cm ² /sec
Effective diffusion coefficient	D_e	=	1.26E-03	cm²/sec
Depth of contamination or C _{sg}	X	=	3.05E+00	m
Calculated Flux	F_x	=	5.98E+01	mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	Af	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m ³ /hr
Indoor air component	C_i	=	2.95E-01 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³
C. TOTAL INDOOR AIR CONCENTRATION	C_t	=	2.95E-01 mg/m³

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m ³ /hr
Inhalation rate	IR	=	4.80E+01 m ³ /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
Chemical Intake (carc. risk)	IT_c	=	1.54E-02 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	4.62E-02 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	4.62E-02 mg/kg-day
Reference dose	RfD	=	1.40E-01 mg/kg-day
Hazard Index	HI	=	3.30E-01

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	1.54E-02 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
Cancer Risk	Risk	=	No Slope Factor

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: MTBE

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	8.50E+04	mg/mole
Vapor pressure	VP	=	3.29E-01	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=		ug/l
Henry's Law Constant	H	=	2.40E-02	dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	0.00E+00	mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=		mg/kg
Henry's Law Constant	H	=	2.40E-02	dimensionless
Bulk density (dry)	ρ _b	=	1.54E+00	gm/cc
Air-filled porosity	θ _a	=	1.66E-01	dimensionless
Water-filled porosity	θ _w	=	2.57E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	1.04E-01	dimensionless
Organic carbon partition coefficient	K _{oc}	=	6.00E+00	cm ³ /gm
Soil/water distribution coef.	K _d	=	6.26E-01	cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00	mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg} (m)	=	7.41E+06	mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 7.41E+06 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.23E-01	dimensionless
Air-filled porosity	θ _a	=	1.66E-01	dimensionless
Diffusion coefficient in air	D _a	=	8.00E-02	cm ² /sec
Effective diffusion coefficient	D_e	=	1.12E-03	cm²/sec
Depth of contamination or C _{sg}	X	=	3.05E+00	m
Calculated Flux	F_x	=	9.82E+02	mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m ³ /hr
Indoor air component	C_i	=	4.85E+00 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³

C. TOTAL INDOOR AIR CONCENTRATION

$$C_t = 4.85E+00 \text{ mg/m}^3$$

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m ³ /hr
Inhalation rate	IR	=	4.80E+01 m ³ /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
Chemical Intake (carc. risk)	IT_c	=	2.53E-01 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	7.59E-01 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	7.59E-01 mg/kg-day
Reference dose	RfD	=	2.30E+00 mg/kg-day
Hazard Index	HI	=	3.30E-01

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	2.53E-01 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
Cancer Risk	Risk	=	No Slope Factor

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Naphthalene

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.30E+05	mg/mole
Vapor pressure	VP	=	1.00E-04	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	ug/l
Henry's Law Constant	H	=	2.00E-02 dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	0.00E+00 mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg
Henry's Law Constant	H	=	2.00E-02 dimensionless
Bulk density (dry)	ρ _b	=	1.54E+00 gm/cc
Air-filled porosity	θ _a	=	1.66E-01 dimensionless
Water-filled porosity	θ _w	=	2.57E-01 dimensionless
Weight fraction of organic carbon	f _{oc}	=	1.04E-01 dimensionless
Organic carbon partition coefficient	K _{oc}	=	1.20E+03 cm ³ /gm
Soil/water distribution coef.	K _d	=	1.25E+02 cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00 mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg}(m)	=	1.14E+04 mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 1.14E+04 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.23E-01	dimensionless
Air-filled porosity	θ _a	=	1.66E-01	dimensionless
Diffusion coefficient in air	D _a	=	5.90E-02	cm ² /sec
Effective diffusion coefficient	D_e	=	8.28E-04	cm²/sec
Depth of contamination or C _{sg}	X	=	3.05E+00	m
Calculated Flux	F_x	=	1.11E+00	mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m ³ /hr
Indoor air component	C_i	=	5.50E-03 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³
C. TOTAL INDOOR AIR CONCENTRATION	C_t	=	5.50E-03 mg/m³

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m ³ /hr
Inhalation rate	IR	=	4.80E+01 m ³ /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
Chemical Intake (carc. risk)	IT_c	=	2.87E-04 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	8.61E-04 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	8.61E-04 mg/kg-day
Reference dose	RfD	=	2.60E-03 mg/kg-day
Hazard Index	HI	=	3.31E-01

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	2.87E-04 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
Cancer Risk	Risk	=	No Slope Factor

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Toluene

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	9.20E+04 mg/mole
Vapor pressure	VP	=	3.74E-02 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00 mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	ug/l
Henry's Law Constant	H	=	2.70E-01 dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	0.00E+00 mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg
Henry's Law Constant	H	=	2.70E-01 dimensionless
Bulk density (dry)	ρ _b	=	1.54E+00 gm/cc
Air-filled porosity	θ _a	=	1.66E-01 dimensionless
Water-filled porosity	θ _w	=	2.57E-01 dimensionless
Weight fraction of organic carbon	f _{oc}	=	1.04E-01 dimensionless
Organic carbon partition coefficient	K _{oc}	=	1.40E+02 cm ³ /gm
Soil/water distribution coef.	K _d	=	1.46E+01 cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00 mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg}(m)	=	2.55E+05 mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 2.55E+05 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.23E-01 dimensionless
Air-filled porosity	θ _a	=	1.66E-01 dimensionless
Diffusion coefficient in air	D _a	=	8.70E-02 cm ² /sec
Effective diffusion coefficient	D_e	=	1.22E-03 cm²/sec
Depth of contamination or C _{sg}	X	=	3.05E+00 m
Calculated Flux	F_x	=	3.68E+01 mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m ³ /hr
Indoor air component	C_i	=	1.81E-01 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³
C. TOTAL INDOOR AIR CONCENTRATION	C_t	=	1.81E-01 mg/m³

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m ³ /hr
Inhalation rate	IR	=	4.80E+01 m ³ /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
 Chemical Intake (carc. risk)	IT_c	=	9.47E-03 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	2.84E-02 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	2.84E-02 mg/kg-day
Reference dose	RfD	=	8.60E-02 mg/kg-day
Hazard Index	HI	=	3.30E-01

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	9.47E-03 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
Cancer Risk	Risk	=	No Slope Factor

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Trichlorofluoromethane (Freon 11)

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	1.40E+05 mg/mole
Vapor pressure	VP	=	1.05E+00 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00 mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	ug/l
Henry's Law Constant	H	=	4.00E+00 dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	0.00E+00 mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg
Henry's Law Constant	H	=	4.00E+00 dimensionless
Bulk density (dry)	ρ _b	=	1.54E+00 gm/cc
Air-filled porosity	θ _a	=	1.66E-01 dimensionless
Water-filled porosity	θ _w	=	2.57E-01 dimensionless
Weight fraction of organic carbon	f _{oc}	=	1.04E-01 dimensionless
Organic carbon partition coefficient	K _{oc}	=	1.60E+02 cm ³ /gm
Soil/water distribution coef.	K _d	=	1.67E+01 cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00 mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg}(m)	=	5.92E+05 mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 5.92E+05 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.23E-01 dimensionless
Air-filled porosity	θ _a	=	1.66E-01 dimensionless
Diffusion coefficient in air	D _a	=	8.70E-02 cm ² /sec
Effective diffusion coefficient	D_e	=	1.22E-03 cm²/sec
Depth of contamination or C _{sg}	X	=	3.05E+00 m
Calculated Flux	F_x	=	8.53E+01 mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m ³ /hr
Indoor air component	C_i	=	4.21E-01 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³
C. TOTAL INDOOR AIR CONCENTRATION	C_t	=	4.21E-01 mg/m³

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m ³ /hr
Inhalation rate	IR	=	4.80E+01 m ³ /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
Chemical Intake (carc. risk)	IT_c	=	2.20E-02 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	6.60E-02 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	6.60E-02 mg/kg-day
Reference dose	RfD	=	2.00E-01 mg/kg-day
Hazard Index	HI	=	3.30E-01

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	2.20E-02 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
Cancer Risk	Risk	=	No Slope Factor

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

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Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Xylenes

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.10E+05	mg/mole
Vapor pressure	VP	=	1.05E-02	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	ug/l	
Henry's Law Constant	H	=	3.00E-01	dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	0.00E+00	mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg	
Henry's Law Constant	H	=	3.00E-01	dimensionless
Bulk density (dry)	ρ _b	=	1.54E+00	gm/cc
Air-filled porosity	θ _a	=	1.66E-01	dimensionless
Water-filled porosity	θ _w	=	2.57E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	1.04E-01	dimensionless
Organic carbon partition coefficient	K _{oc}	=	2.00E+02	cm ³ /gm
Soil/water distribution coef.	K _d	=	2.09E+01	cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00	mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg} (m)	=	7.36E+05	mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 7.36E+05 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.23E-01	dimensionless
Air-filled porosity	θ _a	=	1.66E-01	dimensionless
Diffusion coefficient in air	D _a	=	7.00E-02	cm ² /sec
Effective diffusion coefficient	D_e	=	9.82E-04	cm²/sec
Depth of contamination or C _{sg}	X	=	3.05E+00	m
Calculated Flux	F_x	=	8.54E+01	mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m ³ /hr
Indoor air component	C _i	=	4.21E-01 mg/m ³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C _o	=	0.00E+00 mg/m ³
C. TOTAL INDOOR AIR CONCENTRATION	C _t	=	4.21E-01 mg/m ³

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m ³ /hr
Inhalation rate	IR	=	4.80E+01 m ³ /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
Chemical Intake (carc. risk)	IT _c	=	2.20E-02 mg/kg-day
Chemical Intake (non-carc. risk)	IT _{nc}	=	6.60E-02 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	6.60E-02 mg/kg-day
Reference dose	RfD	=	2.00E-01 mg/kg-day
Hazard Index	HI	=	3.30E-01

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	2.20E-02 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
Cancer Risk	Risk	=	No Slope Factor

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: 1,2-Dichloroethane (EDC)

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00 dimensionless
Molecular weight	MW	=	9.90E+04 mg/mole
Vapor pressure	VP	=	1.14E-01 atm
Universal gas constant	R	=	8.20E-05 atm-m3/mole-K
Temperature	T	=	2.93E+02 K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00 mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	ug/l
Henry's Law Constant	H	=	4.00E-02 dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	0.00E+00 mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg
Henry's Law Constant	H	=	4.00E-02 dimensionless
Bulk density (dry)	ρ _b	=	1.54E+00 gm/cc
Air-filled porosity	θ _a	=	1.66E-01 dimensionless
Water-filled porosity	θ _w	=	2.57E-01 dimensionless
Weight fraction of organic carbon	f _{oc}	=	1.04E-01 dimensionless
Organic carbon partition coefficient	K _{oc}	=	3.80E+01 cm ³ /gm
Soil/water distribution coef.	K _d	=	3.96E+00 cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00 mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg}(m)	=	3.35E+02 mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 3.35E+02 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.23E-01 dimensionless
Air-filled porosity	θ _a	=	1.66E-01 dimensionless
Diffusion coefficient in air	D _a	=	1.00E-01 cm ² /sec
Effective diffusion coefficient	D_e	=	1.40E-03 cm²/sec
Depth of contamination or C _{sg}	X	=	3.05E+00 m
Calculated Flux	F_x	=	5.55E-02 mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m ³ /hr
Indoor air component	C_i	=	2.74E-04 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³
C. TOTAL INDOOR AIR CONCENTRATION	C_t	=	2.74E-04 mg/m³

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m ³ /hr
Inhalation rate	IR	=	4.80E+01 m ³ /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
Chemical Intake (carc. risk)	IT_c	=	1.43E-05 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	4.29E-05 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	4.29E-05 mg/kg-day
Reference dose	RfD	=	2.70E-02 mg/kg-day
Hazard Index	HI	=	1.59E-03

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	1.43E-05 mg/kg-day
Slope factor (potency)	SF	=	7.00E-02 1/(mg/kg-day)
Cancer Risk	Risk	=	1.00E-06

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 1-2

Risk Calculations

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Dichlorodifluoromethane

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.20E+05	mg/mole
Vapor pressure	VP	=	5.77E+00	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	ug/l	
Henry's Law Constant	H	=	4.10E+00	dimensionless
Calculated soil gas concentration	C_{sg}(gw)	=	0.00E+00	mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg	
Henry's Law Constant	H	=	4.10E+00	dimensionless
Bulk density (dry)	ρ _b	=	1.54E+00	gm/cc
Air-filled porosity	θ _a	=	1.66E-01	dimensionless
Water-filled porosity	θ _w	=	2.57E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	1.04E-01	dimensionless
Organic carbon partition coefficient	K _{oc}	=	5.80E+01	cm ³ /gm
Soil/water distribution coef.	K _d	=	6.05E+00	cm ³ /gm
Calculated soil gas concentration	C_{sg}(s)	=	0.00E+00	mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C _{sg} (m)	=	1.84E+05	mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 1.84E+05 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.23E-01	dimensionless
Air-filled porosity	θ _a	=	1.66E-01	dimensionless
Diffusion coefficient in air	D _a	=	8.00E-02	cm ² /sec
Effective diffusion coefficient	D_e	=	1.12E-03	cm²/sec
Depth of contamination or C _{sg}	X	=	3.05E+00	m
Calculated Flux	F_x	=	2.44E+01	mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	Af	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m ³ /hr
Indoor air component	C_i	=	1.20E-01 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³
C. TOTAL INDOOR AIR CONCENTRATION	C_t	=	1.20E-01 mg/m³

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m ³ /hr
Inhalation rate	IR	=	4.80E+01 m ³ /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
 Chemical Intake (carc. risk)	IT_c	=	6.28E-03 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	1.89E-02 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	1.89E-02 mg/kg-day
Reference dose	RfD	=	5.70E-02 mg/kg-day
Hazard Index	HI	=	3.31E-01

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	6.28E-03 mg/kg-day
Slope factor (potency)	SF	=	0.00E+00 1/(mg/kg-day)
Cancer Risk	Risk	=	No Slope Factor

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL
Risk Calculations

Page 1-2

Version: November 1999

Project Name: BRC Former Boeing C-6 Facility, Los Angeles, California

Chemical: Carbon tetrachloride

Variable Descriptions	Units
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CALCULATION OF SOIL GAS CONCENTRATION

A. SOURCE - Free Product/Soil>100mg/kg.

Mole fraction	MF	=	0.00E+00	dimensionless
Molecular weight	MW	=	1.50E+05	mg/mole
Vapor pressure	VP	=	1.51E-01	atm
Universal gas constant	R	=	8.20E-05	atm-m3/mole-K
Temperature	T	=	2.93E+02	K
Calculated soil gas concentration	C_{sg}(fp)	=	0.00E+00	mg/m3

B. SOURCE - Groundwater

Water contamination level	C _w	=	ug/l	
Henry's Law Constant	H	=	1.20E+00	dimensionless
Calculated soil gas concentration	C_{sg(gw)}	=	0.00E+00	mg/m3

C. SOURCE - Soil < 100 mg/kg

Soil contamination level	C _t	=	mg/kg	
Henry's Law Constant	H	=	1.20E+00	dimensionless
Bulk density (dry)	ρ _b	=	1.54E+00	gm/cc
Air-filled porosity	θ _a	=	1.66E-01	dimensionless
Water-filled porosity	θ _w	=	2.57E-01	dimensionless
Weight fraction of organic carbon	f _{oc}	=	1.04E-01	dimensionless
Organic carbon partition coefficient	K _{oc}	=	1.50E+02	cm ³ /gm
Soil/water distribution coef.	K _d	=	1.56E+01	cm ³ /gm
Calculated soil gas concentration	C_{sg(s)}	=	0.00E+00	mg/m3

D. SOURCE - Measured Soil Gas

Measured soil gas concentration	C_{sg(m)}	=	2.00E+02	mg/m3 (ug/l)
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E. SOIL GAS CONCENTRATION USED IN RISK CALCULATIONS >>> 2.00E+02 mg/m3

DIFFUSIVE TRANSPORT UPWARD IN UNSATURATED ZONE

Total porosity	θ	=	4.23E-01	dimensionless
Air-filled porosity	θ _a	=	1.66E-01	dimensionless
Diffusion coefficient in air	D _a	=	7.80E-02	cm ² /sec
Effective diffusion coefficient	D_e	=	1.09E-03	cm²/sec
Depth of contamination or C _{sg}	X	=	3.05E+00	m
Calculated Flux	F_x	=	2.58E-02	mg/m²-hour

SITE ASSESSMENT & MITIGATION VAPOR RISK ASSESSMENT MODEL

Page 2-2

Risk Calculations

Version: November 1999

CALCULATING VAPOR CONCENTRATION IN BUILDING

A. INDOOR AIR COMPONENT

Floor area of building	A	=	1.00E+00 m ²
% of floor area that flux occurs		=	1.00E+00 dimensionless
Attenuation factor(Crack factor)	S _b	=	1.00E-02 dimensionless
Flux area within building	A _f	=	1.00E-02 m ²
Interior Height of building	R _h	=	2.44E+00 m
Volume of building	V	=	2.44E+00 m ³
Exchange rate of air	E	=	8.30E-01 exchanges/hr
Ventilation rate	Q	=	2.03E+00 m ³ /hr
Indoor air component	C_i	=	1.28E-04 mg/m³

B. OUTDOOR AIR COMPONENT

Downwind contamination length	L	=	0.00E+00 m
Wind speed	u	=	0.00E+00 m/hr
Height of building openings (or height of breathing zone)	h	=	2.00E+00 m
Outdoor air component	C_o	=	0.00E+00 mg/m³
C. TOTAL INDOOR AIR CONCENTRATION	C_t	=	1.28E-04 mg/m³

EXPOSURE SCENARIO

Body weight	BW	=	7.00E+01 kg
Inhalation rate	IR	=	2.00E+00 m ³ /hr
Inhalation rate	IR	=	4.80E+01 m ³ /day
Exposure duration	ED	=	2.50E+01 yrs
Hours per day	conversion	=	8.00E+00 hr/day
Exposure time	ET	=	3.33E-01 hr/24 hours
Days per week	conversion	=	5.00E+00 days/week
Weeks per year	conversion	=	5.00E+01 weeks/yr
Exposure frequency	EF	=	2.50E+02 days/yr
Averaging Time (carc. risk)	AT	=	2.74E+04 days
Averaging Time (non-carc. risk)	AT	=	9.13E+03 days
 Chemical Intake (carc. risk)	IT_c	=	6.66E-06 mg/kg-day
Chemical Intake (non-carc. risk)	IT_{nc}	=	2.00E-05 mg/kg-day

NON-CARCINOGENIC RISK (Chronic Risk)

Chemical Intake (non-carc. risk)	IT _{nc}	=	2.00E-05 mg/kg-day
Reference dose	RfD	=	6.86E-04 mg/kg-day
Hazard Index	HI	=	2.91E-02

CARCINOGENIC RISK

Chemical Intake (carc. risk)	IT _c	=	6.66E-06 mg/kg-day
Slope factor (potency)	SF	=	1.50E-01 1/(mg/kg-day)
Cancer Risk	Risk	=	9.99E-07

GEOTECHNICAL PARAMETERS

Sample ID	Date Sampled	Depth (feet bgs)	Sieve Analysis (Soil Type)	Dry Bulk Density (g/cm ³)	Moisture Content (percent by weight)	Total Porosity (fraction by volume)	Air-filled Porosity (fraction by volume)	Water-filled Porosity (fraction by volume)	TOC* (mg/kg)	f _{oc} (fraction by weight)
I-34-4.5	1/22/2001	4.5	Silt	1.87		0.31	0.05	0.26	610	0.06
EIA290176-001 (I-34-5)	1/29/2001	5	Silt	1.51	15.9	0.43	0.19	0.24	520	0.05
EIA290176-010 (D-29-5)	1/29/2001	5	Silt	1.44	20.3	0.46	0.16	0.29	2350	0.24
EIA29176-018 (I-25-5)	1/29/2001	5	Silt	1.34	17.8	0.49	0.26	0.24	690	0.07
Average				1.54						
					0.42	0.17		0.26	1043	0.10

Notes:

The air-filled porosity values were calculated from gravimetric data, not volumetric data.

* f_{oc} = the weight fraction of organic carbon in soil = TOC/10,000

CHEMICAL PARAMETERS

CAS No.	More prevalent and higher concentration volatile organic chemicals (VOCs)	MW (mg/mole)	H' (dimension-less)	Da (cm ² /sec)	VP (atm)	Temp. (°C)	K _{oc} (cm ³ /g)	Water Solubility (mg/L-water)	CSF (inh) (mg/kg-day) ⁻¹	Chronic RfD (inh) (mg/kg-day)
79-01-6	Trichloroethylene (TCE)	1.3E+05	a	4.2E-01	a	7.9E-02	a	7.6E-02	20 b	9.4E+01 a
127-18-4	Tetrachloroethylene (PCE)	1.7E+05	a	7.5E-01	a	7.2E-02	a	2.4E-02	25 b	2.7E+02 a
75-09-2	Methylene Chloride	8.5E+04	a	9.0E-02	a	1.0E-01	a	5.7E-01	25 b	1.0E+02 c
71-55-6	1,1,1-Trichloroethane (1,1,1-TCA)	1.3E+05	a	7.1E-01	a	7.8E-02	a	1.6E-01	25 b	1.3E+04 a
75-35-4	1,1-Dichloroethylene (1,1-DCE)	9.7E+04	a	1.1E+00	a	9.0E-02	a	7.8E-01	25 b	1.4E+02 a
156-59-2	cis-1,2-Dichloroethylene (cis 1,2-DCE)	9.7E+04	a	1.7E-01	a	7.4E-02	a	2.4E-04	20 b	6.5E+01 a
156-60-5	trans-1,2-Dichloroethylene (trans-1,2-DCE)	9.7E+04	a	3.8E-01	a	7.1E-02	a	5.2E-01	30 b	3.6E+01 a
75-01-4	Vinyl Chloride	6.3E+04	a	1.1E+00	a	1.1E-01	a	3.5E+00	25 b	1.9E+01 a
75-34-3	1,1 - Dichloroethane (1,1-DCA)	9.9E+04	a	2.3E-01	a	7.4E-02	a	3.1E-01	25 b	2.80E+03 a
79-00-5	1,1,2 - TCA,	1.3E+05	a	3.7E-02	a	7.8E-02	a	3.1E-02	25 b	5.3E+01 a
71-43-2	Benzene	7.8E+04	a	2.3E-01	a	8.8E-02	a	1.2E-01	25 b	7.5E+01 a
67-86-3	Chloroform	1.2E+05	a	1.5E-01	a	1.0E-01	a	2.6E-01	25 b	6.2E+01 a
100-41-4	Ethylbenzene	1.1E+05	a	3.2E-01	a	7.5E-02	a	1.3E-02	25 b	5.3E+01 a
78-93-3	Methyl Ethyl Ketone	7.2E+04	a	1.1E-03	a	9.0E-02	a	1.2E-01	25 b	2.0E+02 a
1634-04-4	MTBE	8.5E+04	a	2.4E-02	a	8.0E-02	a	3.3E-01	25 b	4.5E+00 a
91-20-3	Naphthalene	1.3E+05	a	2.0E-02	a	5.9E-02	a	1.0E-04	25 b	6.0E+00 a
108-88-3	Toluene	9.2E+04	a	2.7E-01	a	8.7E-02	a	3.7E-02	25 b	1.2E+03 a
75-69-4	Trichlorofluoromethane (Freon 11)	1.4E+05	a	4.0E+00	a	8.7E-02	a	1.0E-00	25 b	1.4E+02 a
1330-20-7	Xylenes	1.1E+05	a	3.0E-01	a	7.0E-02	a	1.1E-02	25 b	1.6E+02 a
107-06-2	1,2-Dichlorethane (EDC)	9.9E+04	a	4.0E-02	a	1.0E-01	a	1.1E-01	25 b	3.8E+01 a
75-71-8	Dichlorodifluoromethane	1.2E+05	a	4.1E+00	a	8.0E-02	a	5.8E+00	21 b	5.8E+01 a
56-23-5	Carbon tetrachloride	1.5E+05	a	1.2E+00	a	7.8E-02	a	1.5E-01	25 b	2.8E+02 a

References:

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- d Risk Assessment Information System (RAIS) Toxicity & Chemical-Specific Factors Data Base, January 2001, <http://risk.itsd.dmlt.gov/cgi-bin/risk/TOX>, select=csf
- e Cal-EPA, Air Resources Board (ARB), Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values, October 10, 2000, <http://www.arb.ca.gov/ab2588/riskassess.htm>
- Toxicity Value reference priority:
1. Cal-EPA, Office of Environmental Health Hazard Assessment (OEHHA), Toxicity Criteria Database and December 2000 California Cancer Potency Values, <http://www.oehha.ca.gov/risk/chemicalDB/index.asp>
 2. Cal-EPA, Air Resources Board (ARB), Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values, October 10, 2000, <http://www.arb.ca.gov/ab2588/riskassess.htm>
 3. EPA Region 9, Preliminary Remediation Goals (PRGs), 2000.